THE AMERICAN GAS LIGHT JOURNAL

REDMANRKENNY.N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LXIV.—No. 8. Whole No. 1,081. | NEW YORK, MONDAY, FEBRUARY 24, 1896 | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Terms of Subscription, Including Postage—For the United States and Canada, $3 per annum. European countries, $4.5) (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
- Twelfth Annual Meeting of the Ohio Gas Light Association..... 281
- Notice Respecting the "Wrinkle Department," Western Gas Association..... 281

EDITORIALS—
- Special Editorial Correspondence—New England Association Meeting..... 281
- Advance Circular from the Comm ttee on Research, American Gas Light Association..... 282
- The Standard of Light, by Mr. W. J. Dibdin, F.I.C., etc..... 284
- A Proposed Improvement in Arrangement of Service of Night Watchmen..... 289
- Dielectric Strength of Oils under Alternating Potentials, by Mr. Elihu Thomson..... 290
- The Safe and Economical Management of a Steam Plant, by Mr. Chas. E. Garlick, M.E..... 291

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 292
Gas Coal Contract—Officers Elected, Washington (D. C.) Company—Annual Meeting, New York and Cleveland Gas Coal Co.—An Inquiry by Council Concerning the Affairs of the Baltimore Company—To Consolidate the Gas Interests of Boston—The Decision by the Massachusetts State Board on the Malden Petition—The Columbus (Ga.) Company's Liberality—Contract for the Berlin Iron Bridge Co.—Annual Meeting, Independence, Mo.—The San Francisco Company Still Looking for an Office Building—Cheaper Gas for Little Falls, N. Y.—Annual Meeting, Augusta, Ga.—Resignation of Mr. Jno. Mather—Will Los Angeles (Cal.) Have an Opposition Company?—Resolutions Respecting the Death of Mr. W. B. Brooks—Meter Inspection, Detroit, Mich.—The Bill to Consolidate the Boston Companies—The Capital City Company Accepts the New Gas Ordinance—And Other Items.

- The Market for Gas Securities..... 295

[OFFICIAL NOTICE.]

Twelfth Annual Meeting of the Ohio Gas Light Association.

OFFICE OF THE SECRETARY, COLUMBUS, O., Feb. 8, 1896.

To the Members of the Ohio Gas Light Association:

The twelfth annual meeting of this Association will be held at Cincinnati, O., on Wednesday and Thursday, March 18 and 19, 1896. The Grand Hotel has been selected as headquarters, and its facilities for accommodating the convention are the best.

A portion of Thursday morning will be devoted to an executive session, of which no stenographic report will be made, when it is hoped members will feel freer to talk upon subjects of interest and importance to the Association.

Please arrange to attend and help make the meeting a success.

Yours truly, A. P. LATHROP, Sec'y.

[OFFICIAL NOTICE.]

Notice Respecting the "Wrinkle Department," Western Gas Association.

OFFICE OF THE SECRETARY, NEW ALBANY, IND., Feb. 10, 1896.

Contributions to the "Wrinkle Department," of which Mr. Geo. T. Thompson, of St. Louis, is editor, should be sent to him not later than March 20. The "Wrinkle Department" is a distinctive and valuable feature of the meetings of the Western Gas Association. Its success has been due wholly to the personal solicitations of its editor, who has been persistent in his efforts to collect a valuable contribution. This year it is hoped that contributors will voluntarily and promptly send Mr. Thompson their "Wrinkles" for the Chattanooga meeting.

JAMES W. DUNBAR, Sec'y.

[By Telegraph.]

SPECIAL EDITORIAL CORRESPONDENCE, NEW ENGLAND ASSOCIATION MEETING.

YOUNG'S HOTEL, BOSTON, MASS., Feb. 20, 1896.

Dear JOURNAL: I appreciate the difficulty of forwarding in time for your next issue a sequentially coherent account of the New England's 26th annual meeting, keeping in mind, as I do, the perverse facts that confront me. One of the "facts" is that the phase of the moon which determines when Easter day this year shall be, also determined that Ash Wednesday and the constitutional first day of the New England meeting were to be in conflict, which clash took out 24 hours from your usual time for getting out the issue; for the New England men would never (and properly so) gather in the banquet hall when many others the country over were still stained with the ashen marks of the first day of the orthodox public penitential time. The second fact is that the anniversary of the birth of our country's greatest man takes out another day from your time for the preparation of "our next." Nor do I regret this general observance of our hero's memory; on the contrary, I rejoice that printers and pressmen are so well alive to it, even if correspondents and editors are thus shorn of the usual facilities of telling in the shortest possible time to their readers all they heard and saw. In this understanding let me attempt to give the history of the first day in half-tone stenography.

Wednesday evening a fair number of representatives of the New England fraternity gossiped in the cozy recesses of Young's, while the snow was softly falling over cultured Boston, and I am pleased to say that some of the gossip was as music to the ear. For instance, the men at the helm of five important Eastern Companies admitted that gains in

sendout for the latter half of '95, as compared with the corresponding period of '94, had been most pronounced, which will readily be believed when I say that the average for the five was an advance of 13.20 per cent. With that knowledge as a sleeping potion, abetted by the creature comforts of Young's complete abiding place, we were all contented this morning to saunter into the meeting room to listen to the proceedings, out of which each hoped to cull something that would fit his particular case in respect of taking care of the business that he had and to learn how to keep up with the increase in his trade. Well, President Lamson and Secretary Prichard greeted a representative attendance, when, at 10:15, the call to order sounded. Following the roll came the election of new members, whose names I forward: D. F. Burritt, Rockville, Conn.; G. E. Cowperthwait, Danbury, Conn.; Jas. Dickens, Newburyport, Mass.; S. Hurlburt, Norwich, Conn.; H. K. Morrison, Concord, N. H; and G. W. Mansfield, Salem, Mass.—all in the Active class. The Associates elected were: Geo. A. Alden, Watertown, Mass.; A. C. Burrage, Boston, Mass.; Ralph W. Cook, Woonsocket, R. I.; Robert Todd, Walnut Hill, Mass.; and Wm. R. Wardwell, Boston, Mass. This, it seems to me, is a right good showing, especially for an Association which up to the present time has not manifested any disposition to engage in the kindergarten line. President Lamson's address was quite in keeping with his studious, unexaggerated ways, but I would have been better satisfied had he been a trifle more pronounced over the calcic carbide subject. However, there's more on that to come. The reading of the correspondence connected with the meeting brought out a fraternal telegram from the Texas Gas and Electric Light Association that evoked a hearty outburst of applause. Next came the memorial report on deceased members, which dealt with the time and work of the late Mr. James A. Hadley and the late Mr. William Tarbell. The tributes were fraternally told and fraternally received. The annual reports of the methodical man from Lynn having revealed his successful care of the Association's records and finances, the members settled down for a hearing of the first paper, that by Mr. C.W. Hinman, of Boston, entitled, "Some Notes on Photometry." The paper was thorough and interesting, and justly provoked a discussion that was participated in by many of the veterans, whose practical knowledge of "lighting effect" might more often than not be placed against the theoretical acumen of those who would seek to measure light as all would (to paraphrase Mr. Chollar) weigh beef. The election of officers, which, of course, was but an indorsement of the report of the Nominating Committee, resulted thuswise:

President—Chas. D. Lamson, Worcester, Mass.
First Vice-President—S. J. Fowler, Springfield, Mass.
Second Vice-President—Walter R. Addicks, Boston, Mass.
Secretary and Treasurer—Chas F. Prichard, Lynn, Mass.
Directors—Col. F. S. Richardson, W. A. Learned, H. A. Atwood, N. W. Gifford and C. J. R. Humphreys.

The list certainly is a good one, but for the next year the Association could consistently alter its title to that of the Massachusetts Association of Gas Engineers, since every office-bearer—to the last on the Directors' list—is a Bay State man. The proceedings subsequent to the adjournment for dinner were ushered in by Mr. Allen's paper on "Development of Candle Power," which subject, although treated in good, practical vein by the writer, failed in the discussion. If Mr. C. M. Higgins could have gone East instead of West (which latter empire, I understand, is the one that holds him now), at this time, I have no doubt, the discussion would have been livelier.

At 3 o'clock Mr. W. R. Addicks commenced to read his paper on "Acetylene," taking up an hour for the presentation of his subject, and illustrating his remarks by means of lantern slide projection. He was listened to closely and the paper brought out a good discussion. Mr. Addicks, however, presented nothing that was particularly new, although the series of tables given are plain, understandable and honest. His calculations were mainly based on figures from the Spray tinkering forge, and it is noteworthy that even these "estimates" bring the cost of a net ton of doubtful calcic carbide up to $22.75. The discussion on the paper virtually brought the business sessions for the day to a close. The banquet was thoroughly enjoyed, for it was well served, and the proceedings were neatly directed by Mr. Wood, as toastmaster. Members and guests to the number of 90 shared its harmonies of foods, material and mental.—C.

BOSTON, MASS., Friday, Feb. 21, 1896.

Dear JOURNAL: I chance that this will be in time before you go to press. The second day's sessions are underway, with the suitable accompaniments of bright, invigorating weather and a large attendance. The paper by Mr. N. W. Gifford, on "Temperature Corrections," opened the proceedings, and it led to a lively discussion, in which Messrs. McKay, Prichard, Wood and Addicks showed to great advantage. Amongst the telegrams read to day were two particularly appropriate ones—from Mr. E. C. Jones, of San Francisco, whose "'eart is true to Poll," and from Mr. Jos. Gwynn, of Steubenville, O. The paper by Mr. George Barrows is now "on," and it will be followed by that arranged by Mr. Shelton. Then is to follow the Question Box and "good bye." I will not send anything further, knowing as I do that "time's up." The meeting is an excellent one.—C.

Advance Circular from the Committee on Research, American Gas Light Association.

PHILADELPHIA, February 10th, 1896.

To the Members of the American Gas Light Association:

In the address of the President of your Association, at the meeting held October 17th, 1895, were the following recommendations:

"I recommend to you a Standing Committee on Education, to be composed of the Junior Past President, the First Vice-President, and the Secretary of the Association. The personnel of such a Committee would change slowly, giving some assurance of system and continuity. A list of problems formulated by the Committee and printed in the annual publication would be of great assistance to the student, would extend the influence of the Association, and increase the value of its proceedings. I recommend the establishment of two prizes, in books, for the best and the second best answers to the questions. I think the questions should be graded and the prize answers, with the Committee's comments, published in the annual volume. If the recommendation meets your approval its detail will be worked up by the Committee on Education, when created.

"I further recommend the creation of a Standing Committee on Research, to be composed of the three Vice-Presidents, the Secretary and three members, to be elected; three the first year for terms of one, two and three years, respectively, and thereafter one each year for a term of three years; the President to be ex-officio Chairman. I do not believe in the Association undertaking any extended investigations on its own account for reasons already given. But we must have original investigations if we are to have progress.

"Self interest is the important factor in the work of the world. A sufficient inducement should insure to the American Association, as it has to other scientific bodies, the preparation of reports upon original investigation that will add to the value of its proceedings and membership. I suggest that the Committee, if formed, be authorized to offer a biennial prize of life membership in the Association, and a suitable decoration for the most valuable contribution based upon original investigation, if any of the contributions submitted are, in the judgment of the Committee, of sufficient value to merit the honor. Such a prize should stimulate the ambition of the best of our membership. It would be unique, and the honor of its possession would amply reward the labor of its attainment.

"Its cost to the Association would be insignificant. The Committee might reasonably decide to nominate the subject of the investigation."

The Committee on President's Address recommended, in the main, the adoption of the ideas set forth in the above extracts, amending them to the extent of changing the form of Committees, as shown by the following quotations:

"6th. That an Educational Committee, or Board, be established, with a view at least of thoroughly testing the question of its utility. We do not, however, agree with the President as to the composition of the Board. Men every way qualified for President or Vice-President might, from force of circumstances, their arduous labors, or lack of taste for educational work, be wholly unfitted for serving on such a Board. We recommend that the Council appoint *three members* to constitute such Board *for active work*, and that the Junior Past President and Secretary be ex-officio members of the Board; and that the affirmative vote of three out of the five be necessary to authorize the expenditure of money. The Committee feel that the work suggested by the President, in the educational line, is worthy of the Association's best efforts.

"We advise that the Association adopt the suggestion of the President providing for a Committee on Research. That this Committee be composed of the five members constituting the Educational Board.

"That this Research Committee be authorized to provide some suitable decoration to be awarded to the person submitting to such Committee the most meritorious paper on research or invention pertaining to the lighting industry.

"That the Committee may make such rules as to it shall seem best for the interest of the industry and of this Association.

"That persons competing for the honors must submit their papers to the Research Committee, at least 60 days before the date of the annual meeting of this Association.

"That the Committee may provide for first and second class honors, but not more than one shall be conferred in any one year.

"That awards made by the Committee shall require the confirmation of Council. That the affirmative action of the Council shall be regarded as the action of the Association and make the award of the Research Committee final.

"That the Committee shall not be authorized to expend the Association's money nor to contract debts, except so far as it shall be so instructed by a vote of the Council. But the Committee may, at its discretion, use any money donated to it in aid of research by those desiring to aid the work, the Committee having power to receive in the name of the Association funds donated for such purpose."

These recommendations of the Committee on President's Address were unanimously adopted, and the Committee on Education and Research, as formed, was made up of Messrs. Alex. C. Humphreys, C. F. Prichard, A. E. Forstall, with A. B. Slater, Jr., ex-officio member, and the Junior Past President, Walton Clark, as Chairman.

At a meeting of the Committee it was determined to address the members of the American Association upon the general subject, laying before them a plan which has met the approval of the Committee, and which it is hoped will commend itself to the Association.

The work in the hands of the Committee may be considered under two heads:

1. Education.
2. Encouragement of research.

Education.

It is proposed to form a class of men and youths occupying subordinate positions in gas works, or employed as superintendents of small gas works, to whom shall be mailed, at intervals to be determined later, problems in gas manufacturing and distribution, and questions upon the sciences concerned with the manufacture and distribution of gas, together with suggestions as to the sources of information to be examined in studying the questions involved.

It is proposed to begin the work with but one grade of students, submitting problems and questions of the simplest character, and looking for the success attained to determine the future development of the plan.

The Committee hope that there will be enough of interest manifested to justify an extension of its work to the formation of classes of two grades, and the awarding of certificates of excellency at the termination of a two years' course in either grade.

It is not desired to include in the class now to be formed, students who have had the advantage of advanced or technical education or of considerable experience in the gas business. The work is intended to "give systematic aid to the men and boys, who without the advantage of an advanced education are struggling to fit themselves for positions of responsibility while filling subordinate positions in gas works." To stimulate their interest in the work, certain appropriate and valuable prizes will be awarded for the first, second and third best answers to examination questions, submitted at a time to be determined by the Committee. The prizes will consist of books, drawing implements or chemical apparatus.

If there is in your employ a boy or man answering the above conditions and possessing the earnestness of purpose requisite to perseverance in the line of study to be pursued, will you please give him the inclosed form of application and such assistance as he may need in preparing it for return to the Committee?

All communications should be addressed, A. B. Slater, Jr., Sec'y., P. O. Box 1160, Providence, R. I.

Research.

By the action of the Association this Committee is authorized to invite members of the Association, or others, to submit in competition for a prize, the results of original research in any matter pertaining to the gas lighting industry. The rules governing the award are as follows:

1. Papers submitted in competition must be in the possession of the Secretary at least 60 days prior to the annual meeting of the Association.

2. Papers must be typewritten and enclosed in special envelopes obtained from the Secretary.

3. If but one paper is submitted, it will, if deserving it, receive the prize; and the right to refuse to award a prize, if none of the papers submitted is considered worthy the honor, is reserved by the Committee.

4. Each paper is to remain the property of its writer, except that the American Gas Light Association will have the right to publish it in the official proceedings.

5. The value of the paper to the gas lighting industry will be the sole standard upon which it will be judged.

6. Membership in the Association, or connection with the gas industry, is not necessary to admission to the competition.

The Committee hopes if any man to whom this circular comes has in mind a line of investigation promising results of value to the gas lighting industry, and the time to devote to it, but lacking the necessary books or appliances, or funds for the work, that he will address the Secretary upon the subject. It is possible that the Committee will be able to assist one or more workers in lines that to it appear to promise results of value.

Previous correspondence is not necessary to secure the admission of any paper to the competition for the honor of the Association's decoration and certificate of award, but it is believed that the investigation, and consequently the gas lighting industry, would benefit from a preliminary discussion of the line to be pursued.

Measures will be taken to secure absolute fairness in the examinations of students and the judgments of reports of original work.

Upon these lines does your Committee propose starting the work you have entrusted to it. Your sympathy and co-operation should enable the Committee to gradually develop its present unpretentious plan to a system highly creditable to your Association and valuable to the industry in which you are engaged.

WALTON CLARK, Chairman,
A. B. SLATER, JR., Ex-officio,
A. C. HUMPHREYS,
A. E. FORSTALL,
C. F. PRICHARD,
} Committee.

APPLICATION FOR MEMBERSHIP IN THE PRACTICAL CLASS OF THE AMERICAN GAS LIGHT ASSOCIATION.

[Blank to be Filled in Applicant's Handwriting.]

I, ...hereby make application for membership in the Practical Class of the American Gas Light Association, agreeing that while a member I will make an earnest effort to solve the problems and answer the questions submitted to the class, and to read such things as may be recommended to the class and obtainable by me.

Name in full.....
Age.....

Education—

Primary schools.....
How long?.....
Where?.....
Grammar schools.....
How long?.....
Where?.....
High schools.....
How long?.....
Where?.....
College or Academy.....
How long?.....
Where?.....

Business Experience—State what place or places, with what firms or corporations, kind of work, titles of positions and length of service.

.....
.....
.....
.....

Present Position—Full details of class of work, title, length of service.

.....
.....

Additional Information and Explanations—

.....
.....
.....
.....
.....
.....

Signature.

I, the undersigned, have known ..... for.....years, and believe that if enrolled in the Practical Class of the American Gas Light Association he will prove an earnest and persistent student of its problems and questions. As far as I have knowledge, his statements upon the attached application sheet are correct. .....

Member American Gas Light Association.

....., 1896.

A CHARTER has been issued to the New Castle (Pa.) Gas Engine Company, which is the logical successor of the Connelly Gas Engine Company.

The Standard of Light.

[A paper read before the Society of Arts (London) by Mr. W. J. Dibdin, F. I. C., Chemist and Superintending Gas Examiner of the London County Council.]

On the 21st of December, 1888, I had the honor of reading before the Society of Arts a paper on the subject of the standard of light. In that paper I discussed the position of the question as it then stood; summing up briefly the results of the various inquiries conducted from time to time by authorities in this country and on the Continent. The position in which the question had then arrived may be shortly put thus: The authorities of the Board of Trade—the controlling authority for gas-testing purposes in London—the gas interest generally, as represented by the Gas Institute and the British Association, had all joined in one condemnation of the existing candle, and in demanding an alteration, and, with one exception, that such alteration should consist in the adoption of Mr. Harcourt's pentane air-gas flame.

After careful consideration of these facts, an impartial observer would probably have drawn the conclusion that the time was then ripe for a change, and that legislation would follow without delay. Unfortunately, other counsels prevailed; and we have now arrived at a period seven years later, without the attainment of the alteration so earnestly desired and looked forward to by all those interested in the subject, who have made it one of special study, and who daily experience the discomfort of having their best endeavors marred by the imperfect nature of the standard employed, as by Act of Parliament they are compelled to use the long since discredited candle instead of one or more reliable substitutes.

In view of the uncertainty prevailing in the minds of the parliamentary experts of the Board of Trade, rather than in that of their scientific advisers, a further series of inquiries was instituted by a committee appointed by the Board on December 23, 1891. The committee was composed of representatives of the two controlling authorities for gas testing in London—viz., the City and the London County Council; the three large gas companies (the Gas Light and Coke, the South Metropolitan and the Commercial); the Gas Referees, and two independent representatives of the Board of Trade. In connection with the appointment of this committee, it is to be noted that it was not until the South Metropolitan Gas Company came forward with an offer to meet the expenses that it was constituted, as neither the Board of Trade nor the controlling authorities had funds at their disposal for the purpose. Probably this action on the part of a commercial company forms the strongest argument in favor of the long-desired alteration that can be put into words.

After three years of most patient work, during which all the points were carefully and exhaustively reviewed, the committee issued their report; and the question has consequently taken one more step forward, though, as a matter of fact, the scientific result is, to all intents and purposes, in much the same position—viz., the candles are (if possible) still more hopelessly condemned, and one of the proposed more reliable substitutes is recommended for adoption in their place, Mr. Harcourt's pentane standard has again been vindicated as a reliable and exact standard; and, for practical use in gas testing, the pentane argand, proposed by myself in 1886, has been chosen as a suitable substitute for candles in daily work. It is to be hoped that the unanimous report of a committee, expressely selected so as to include representatives of all the various interests concerned, will result in speedy legislation, and thus at last put an end to a controversy which has been one of the vexed questions of the day for more than twenty years.

In the meantime, it will be desirable that the essential features of this last official report should be fully discussed; and, with that view, I venture to submit the following summarized account of the work of the committee, as given in the report. The various points may be considered in the following order:

1. Unsatisfactory standard furnished by the flame of a sperm candle, by reason of the amount of light which it affords varying over a wide range, under conditions as to the manufacture of the candle, as to its mode of use, and as to the adventitious circumstances attending its employment, which, as a whole, it is not possible to regulate and define.

2. The advisability of continuing to express, as heretofore, in official documents and reports, the quantity of light yielded by coal gas burned under specified conditions, in terms of candle light; the actual comparison, however, having been made between the gas light and some well defined and constant light ascertained to be equal in quantity to, or a definite multiple of, the average light given by the standard sperm candle,

3. The conclusion that, in the present state of experience and knowledge, the source of light to be used as a standard by gas testers generally must be produced by the process of combustion, and be in the nature of a flame.

4. That the 1-candle light flame proposed by Mr. A. Vernon Harcourt does constitute a very exact standard, capable of being reproduced at any time without variation of illuminative value; and that this flame is a true representative of the average light furnished by the sperm candle flame constituting the present standard.

5. Inasmuch, however, as there is a practical advantage in comparing directly the light of such a coal gas flame as is usually tested (being that it is of about 16-candle light value), with a light approximating somewhat in value thereto, the committee submitted to careful examination the flame of the 10-candle light pentane argand proposed by the author as a standard in 1886. This flame is produced by burning a mixture of air and pentane vapor from a suitable argand burner, provided with an opaque screen, by which the light from the upper portion of the flame is cut off. The screen being set at a definite height, the luminosity of this portion of the flame remains constant, even under considerable variations, owing to a compensating action affecting the lower or exposed portion of the flame.

6. The amount of light emitted by the lower portion of the flame is substantially equal to ten times the average light of a standard sperm candle flame, or to ten times the light of Mr. Harcourt's 1-candle pentane air gas flame.

7. That any number of the Dibdin Argand burners may be produced, and may be depended upon to furnish a flame giving, when duly screened at the top, ten times the average amount of light given by a sperm candle.

8. Then follows the recommendation that the pentane air flame furnished by this pentane argand burner be accepted as giving the light of 10 standard candles, and that it be authorized and prescribed for official use in testing the illuminating power of the gas supplied by the London gas companies.

9. With a view to making some provision for future possible improvements and requirements, the committee further recommend that the Gas Referees be authorized, should they at any time see fit, to approve and certify for gas testing any other flame based upon the 10-candle standard defined above, which they may consider suitable for the purpose, whether produced in a like or unlike way, and having the same or a different multiple value; such other flame, however, not to be used for gas testing unless approved by the Board of Trade, and unless the gas companies give their consent to its adoption as a standard.

10. The committee then proceeded to recommend that the illuminating power of coal gas shall continue to be recorded as heretofore, in terms of the light given by a specified number of cubic feet (to wit, 5) burnt per hour from the standard "London" Argand burner, but that the requirement that the gas shall actually be consumed at that rate be rescinded, so as to allow the Gas Referees to sanction a mode of testing in which the gas shall be burned at whatever rate is found requisite in order that it may give a light equal to that of the prescribed number of candles, and in which the illuminative value of the gas shall be calculated as being inversely as the rate at which such gas had been burned during the testing so as to give this amount of light.

The chief error in the amount of light emitted by a candle is due to variations in the character of the wick employed. Exhaustive experiments have shown that the number and size of the threads in the wick, the closeness of the plaiting of the strands, the pull on each strand during plaiting, the previous cleaning of the cotton used, the treatment of the wick by the manufacturer, and the extent to which the wick is stretched when set in the candle mould by the workman, are all factors of considerable importance affecting the light which a candle gives. Various other conditions also influence the result, such as the length of time it has been burning, whether the "cup" of the candle is dry or contains melted sperm, the roughness or smoothness of the wick, the curvature of the wick, etc. Added to these difficulties we have the impossibility of making candles which will burn 120 grains an hour. The Gas Referees' instructions allow the use of a candle burning within 5 per cent. of the prescribed amount; but even this does not overcome the trouble, as candles very frequently burn outside these limits—departures of even 10 to 20 per cent. being by no means unknown.

In Germany, sperm candles have been abandoned for paraffine candles, made under the supervision of the authorities, and specially marked. But the same troubles are experienced as with the sperm candles. The committee, therefore, unhesitatingly recommend the abolition of the candle as a standard of light, and the introduction of some more reliable unit.

The decision of the committee respecting the continuation of the prac-

tice of stating the quantity of light in terms of the candle will doubtless recommend itself to all persons interested in the question. The unit thus expressed is one which is well understood generally, and, while being in itself convenient, it represents a quantity of light which is practically the smallest used in daily life. It is only exceptional radiants, such as the arc light, concentrated by a lens, that emit larger multiples of this unit than a few hundred times its value, and no inconvenience can be experienced in such cases; while the introduction of a new term, such as "Carcel," would lead to unnecessary confusion.

The expression of opinion that the source of light to be used as a standard must be produced by the process of combustion, and be in the nature of a flame, is well advised in view of the experience of the past. As I pointed out in my previous paper, in 1888, numerous investigations had been made as to the possibility of producing a constant light by a process of incandescence of solid bodies, notably platinum. But the unreliability of such methods was well illustrated by the researches of the British Association Committee, aided by the work of this Society, through its Secretary; and since that time no progress seems to have been made in this direction. The suggestion to obtain a constant light by means of the incandescent electric lamp has completely broken down, in consequence of the more or less rapid depreciation of the initial intensity, owing to the gradual discoloration of the interior surface of the glass globe.

The following series of special experiments on this point will serve to show the difficulty with which such a standard would have to contend. The tests were made when the current was practically constant:

Number of Hours the Lamp had been Alight.	Illuminating Power.	Number of Hours the Lamp had been Alight.	Illuminating Power.
0	14.8	453	10.8
96	14.0	520	11.5
168	13.0	612	10.5
307	11.5	709	10.5
357	11.8	761	10.5

The loss of 5.4 per cent. in the first 100 hours might not be considered an insuperable difficulty, as a lamp could be renewed at more frequent intervals. Another practical difficulty, however, is the variation in the voltage of the current; a loss of only 3 per cent. having been found to affect the quantity of light by as much as 27 per cent. From these facts it will be seen that the committee had good reasons for their decision.

The conclusion that Mr. Harcourt's pentane air gas flame constitutes a very exact standard, is only one more piece of evidence in favor of the admirable work of that gentleman. Though the particular form in which the pentane and air are to be employed, if the decision of the committee takes legal effect, has been varied by the introduction of the pentane argand burner, the thanks of the community are due to Mr. Harcourt for first calling attention to the standard combustible material thus adopted. Without his preliminary investigations in this direction, it is probable that the question would have still been farther from solution than it is at present. It is, indeed, only due to that gentleman to place on record once more the altogether admirable work with which his name is associated.

It is to be noted that the work of the committee resulted in the discovery of a point in connection with the 1-candle pentane air gas flame which had been overlooked in certain previous investigations. This was that, when the flame was set by an observer who viewed the whole of the luminous portion, the tip of the flame was put too high as compared with the settings made when the body of the flame was obscured by a screen. A number of experiments made to determine the error thus introduced gave a mean difference of 2.59 per cent. On applying this correction to those average results obtained by means of the pentane flame, when set without the use of a screen, the committee found the following values of the pentane air gas flame as obtained at various periods by different observers, who had compared this proposed standard with candles:

Observer.	Value in Standard Candles.	Date.
Mr. Vernon Harcourt	0.994	1879
Messrs. F. Livesey and W. Brown	0.990	1879
Mr. Harold B. Dixon	0.998	1881
Mr. Dibdin	0.998	1887
" including all experiments	1.016	1887
British Association Committee	1.006	1888
Mr. Greville Williams (a)	1.008	1891
Mr. Greville Williams (b)	1.050	1891
Professor Harold B. Dixon	0.998	1891–2

The mean value of all experiments made between 1878 and 1892 with the pentane unit against standard candles when thus corrected ascribes a value of 1.007 to the pentane flame. If one abnormally high result be omitted, the value becomes 1.001.

Satisfactory as this result was, it was, nevertheless, felt that, in order to reduce as far as possible any errors which atmospheric influences might introduce, it would be best to adopt for the daily testing of gas a standard burner giving a light more nearly approaching that of the flame to be tested, which can be easily worked, and in which slight errors in manipulation shall not give rise to serious errors in the results. The 10-candle pentane Argand seemed to satisfy these conditions, and the committee undertook the requisite experiments to determine the point. The burner used was supplied by Messrs. Sugg & Co., and on standardizing it under the prescribed conditions by the 1-candle pentane air gas unit, it was found to give a value of 10.004 candles. The preliminary experiments to ascertain if very extreme variations in the height of the flame affected the amount of light given out, showed that with the extreme limits possible, which could never be approached with the most careless manipulation, the derivation from the normal value would only raise the standard by 10 per cent., or decrease it by 6.2 per cent.; this latter result being obtained when the flame was tailing above the top of the chimney!

An extended series of observations was made to ascertain within what limits of height of flame the light passing under the screen of the standard burner remained constant. At the same time, the effect of replacing the air with coal gas was tried to see whether any, and, if so, what difference would be caused thereby. The results show that both with air and with coal gas the 10 candle pentane Argand gave practically uniform results with a flame burning between the limits of 2½ inches and 4½ inches in height; while if by any mischance these very wide extremes should be exceeded, the results obtained are slightly in favor of the gas being tested. In like manner, experiments made to ascertain whether the depth of pentane in the carburetor influenced the light, by altering the amount of air space over the surface of the pentane, resulted in showing that, as long as there is sufficient pentane to cover properly the bottom of the carburetor, the results obtained will not vary, while they again establish the fact that atmospheric air may be used instead of coal gas as the carrying medium. Another most important point is that the temperature of the carburetor may vary about 40° Fahr., viz., 40° to 80° Fahr,, without influencing the value of the standard. The only alteration found was in one case, when the level of the pentane was too low; but when the carburetor was kept about half full of pentane, the results were constant.

Testings were further made to ascertain what change, if any, the 10-candle pentane Argand might undergo as the atmospheric pressure varies; and from these the conclusion was drawn that the value of the standard is not materially affected by such variations of atmospheric pressure as commonly occur.

The important point of uniformity was then tested. For this purpose Mr. Sugg was requested to make two dozen of the burners, which were distributed among members of the committee, who found that they all gave results practically identical.

In order to ascertain whether the burner first submitted was capable of modification so as to simplify its construction, without affecting the constancy of the light emitted by the flame when at various heights, a number of experiments were made, with the result that the committee arrived at the conclusion that the 10-candle pentane Argand would, with a slight modification, be in every respect a trustworthy standard when supplied with atmospheric air carrying the vapor of pentane supplied by the carburetor provided. The modification alluded to consisted in the substitution of a rectilinear for a curvilinear solid cone, for greater convenience and certainty in measurement, and defining the distance at which it is to be fixed below the center opening of the burner.

The pentane employed to produce the air gas used in Mr. Harcourt's 1-candle standard, and in the carburetor of the 10-candle pentane Argand, was obtaining by purifying light petroleum by the successive action of sulphuric acid and soda solution, and then distilling at 60° C., at 55° C., and twice at 50° C. It was, however, considered important to obtain samples of pure isopentane from other sources, in order to ascertain if the air gas prepared from them would give the same amount of illumination as with the normal pentane. For this purpose a sample of so-called pure isopentane was obtained from Berlin, but, on examination, it proved to be unsatisfactory. Accordingly Professor T. E. Thorpe was requested to have a sample of pure isopentane prepared. This task he kindly undertook, and with the assistance of Mr. A. Greeves, three specimens were made and submitted to the committee. The method used was, shortly, as follows: The mixture of active and inactive amyl alcohols, obtained by the purification of fusel oil boiling from 120° to

130° C. under a pressure of 760 mm., was converted into a mixture of iodides, which was then reduced to isopentane by means of the zinc copper couple. Three samples were thus prepared from German, Scotch and Irish fusel oils, all the conditions being strictly comparable. These were handed to the committee and experimented upon both with the 1-candle pentane flame and the 10-candle pentane Argand. In the case of the former, it was found that rather more light was yielded by the isopentane than by the normal pentane obtained from petroleum. In the case of the 10-candle pentane Argand, however, identical results were obtained with either sample, this doubtless being due to the remarkable compensating action of the flame yielded by that burner, in a manner similar to the compensating action which takes place when air is replaced with coal gas as the medium for driving forward the vapor of the liquid pentane in the carburetor. This result points to the conclusion that the pentane Argand enables either of these combustible materials to be employed without any practical difference in the amount of light passing under the screen, and employed as a standard. Hence, should there be at any future time a suspicion that commercial pentane has altered in respect of its illuminating value, it can always be standardized by an appeal to the light of the pentane Argand burner fed with air carbureted with pure isopentane.

An important question having been raised by Mr. J. Methven as to the effect of the humidity of the atmosphere upon the amount of light emitted by a luminous flame, the committee gave the matter very careful consideration, and a prolonged series of experiments was undertaken by the Secretary, Professor Vivian B. Lewes, F.I.C., to elucidate the matter. Mr. Methven had found that, when the temperature was practically constant, candles gave, per 120 grains of sperm consumed, a light equal to 1.104 as compared with a constant source of light (Methven screen), and that this was increased to 1.196 when the air in which the candles were burning was dried. This difference in the light value he considered to be due entirely to the removal of the moisture, as the temperature remained the same. He also found that, when air saturated with moisture at increasing temperatures is supplied to a flame, the light value rapidly diminishes, so that between the temperatures of 50° and 75° F. a diminution of 10 per cent. takes place in the light emitted by an Argand flame burning 5 cubic feet of gas per hour, while with a flat flame there is a reduction of 12.2 per cent., and with a gas flame from a 2-candle burner a loss of 13 per cent. is found within the same range of temperature.

Mr. Methven ascribed these differences to the different power of the flames to battle with the aqueous vapor. The result of the committee's experiments was that, by abnormally saturating or drying the air supplied to a flame, variations as great as those obtained by Mr. Methven undoubtedly do occur, yet that, in a well ventilated testing-room, with the temperature kept within a narrow range, no such great differences are to be found. These conclusions were also supported by the experience of Mr. Vernon Harcourt, Mr. Greville Williams and Mr. W. C. Young. It did not, therefore, appear to be necessary to take this otherwise important point into consideration in connection with the inquiry especially as the value of the standard recommended was so close to that of the light to be tested, and thus any variation in the one would be balanced by that in the other.

In view of the definite results obtained, the recommendation of the committee to the effect that the Gas Referees should be authorized, should they at any time see fit, to approve and certify for gas testing any other flame based upon the 10-candle pentane Argand, would appear to be unnecessary, as opening the door to alterations from time to time, and thus again reopening the question which all desire so earnestly to see settled. The provision, however, that no alteration should be so made without the sanction of the Board of Trade and the gas companies would provide a safeguard against any interference with the standard on trivial grounds, and is well advised. But undoubtedly the other parties to the contract, viz., the controlling authorities, as representatives of the public, should be represented with the gas companies, and doubtless this will be provided for in any Act legalizing the present proposed alteration. In that case, no objection can be raised to the clause, and the advantage gained would be that in case the advance of knowledge should place in the hands of the operator a still more convenient and reliable process, it would not be necessary to incur the delay and expense of another Act of Parliament—the needful authority for a change being merely a notification of Gas Referees to that effect.

To many it may seem to be a matter of regret that the question of the method of burning the gas to be tested should have been imported into the inquiry, as tending to complicate the simple matter of the standard of light, especially as it is a question of how far any benefit would arise to the public generally by such a change, the possibility, indeed, being that it would tend solely in favor of the sellers rather than the users of gas. As, however, the gas companies were urgent in representing the desirability of this point, as appears from the notes of the interview which the committee had with the representatives of the Incorporated Institution of Gas Engineers and Incorporated Gas Institute, such an alteration as proposed, viz., "that the requirement that the gas actually be consumed at the rate of 5 cubic feet be rescinded, so as to allow the Gas Referees to sanction a mode of testing in which the gas shall be burned at whatever rate is found requisite, in order that it may give a light equal to that of the prescribed number of candles;" or, in the words of the gas representatives, "that the rate of the consumption of gas to be tested be adjusted as nearly as practicable to the maximum efficiency of the various standard burners"—does, in effect, upset the existing bargain between the gas companies and the public, as repeatedly scantioned by Parliament. The simple substitution of a reliable for an unreliable standard is a question which does affect the existing contract, whereas the committee afford no evidence of an experimental character to warrant the further change thus proposed.

Having thus fully considered the most recent work in this connection in England, it will not be without interest to discuss the most modern work on the Continent on the subject. This is contained in the report of the Dutch Gas Association on Photometry, which was issued in 1894. The report is an able and exhaustive account of a special inquiry upon the whole question of photometry as applied to the estimation of the illuminating power of coal gas, and especially so with regard to the standard of light. After a careful *résumé* of the work hitherto accomplished in this direction, the committee of the Association arrived at the conclusion that none of the existing proposals met all the requirements of an ideal standard; and consequently they proceeded to devise a method which they considered fully answered all purposes. It is to be noted that their report contains no reference to the pentane Argand, which does not appear to have attracted their attention, although it has now been before the public for nearly ten years, but in a less prominent form than it has now assumed in consequence of the work of the Board of Trade committee.

The lamp designed by the Dutch Association is based upon the 1-candle pentane lamp (known as the "P2" lamp) of Mr. Vernon Harcourt, in which that gentleman employed the device, first introduced by myself, of cutting off the top portion of the flame, by means of a screen, in a manner similar to that employed in the pentane Argand. Instead of using pentane for the fuel, a mixture of 9 parts of benzol to 100 parts of sulphuric ether is preferred. Experiments showed that between 7.7 and 11.2 parts of benzol, the effective variation of the light is only 1 per cent.; while between 8.5 and 10.2 parts, it is only 0.1 per cent.; and the light is therefore practically constant when the benzol varies between 8.5 and 10.2 parts to 100 parts of ether. This mixture, made up with ether of .7215 specific gravity and benzol of .886 specific gravity, had a specific gravity of .7335, all at 15° C. But it was found that, after 33 per cent. of the contents of the reservoir had been burned away, the residue retained exactly the original specific gravity of .7335. The mixture had, therefore, evaporated, as a whole, and could thus be used as a standard fuel for the lamp. Various experiments with pure and impure ether showed that no difficulty could be experienced in daily work from casual impurities, although pure ether is recommended for use in standard instruments.

Using this arrangement as a standard, the Dutch committee found that the amyl-acetate lamp = 0.9213 candle, = 0.8333 German candle; the English candle = 1.0854 amyl-acetate lamp, = 0.9045 German candle; the German candle = 1.2 amyl-acetate lamp, = 1.1053 English candles. Three specimens of the carcel lamp were tested with the average result that the carcel is equal to 9.631 English candles. This agrees with Messrs. Kirkham and Sugg's experiments in 1869. They found the carcel to equal 9.6 candles; and the tests made by myself in 1885, when comparing it with the Keates lamp, gave as the result 9.61. A series of tests against the 1-candle pentane air gas flame made at the same time as those with Keates' lamp gave a mean result of 9.35 candles, which, however, corrected for the method of setting the pentane then employed, as above described, by the factor 2.59 per cent.—a correction only discovered seven years later—gives a result equal 9.63 candles.

These remarkable coincidences of the results of different observers at widely different periods, and by equally widely different methods, are not a little satisfactory in many respects; and they serve to show the nature of the work which can be accomplished when a sufficiently large number of experiments are made to eliminate accidental errors due to isolated tests.

From the foregoing *résumé* of the position of the question of providing a substitute, acceptable to all parties, for the present legal candle, it will be seen that all that remains to be done is for Parliament to sanction the proposed change, and, by thus legalizing the pentane Argand, bring to a conclusion a question which has gradually ripened until it would seem as if the last word had been said; and there is nothing to delay the closing scene by parliamentary action. Sufficient time has elapsed since the publication of the report of the committee for a thorough trial of the new standard; and there should be now no question as to the result. It is to be hoped that the discussion of the facts which I have ventured to place before the Society will be such as to strength en the hands of the Board of Trade when dealing with the matter during the ensuing session of Parliament.

Discussion.

The Chairman called upon Mr. Vernon Harcourt to open the discussion.

Mr. Harcourt said he rose at the bidding of the Chairman, but he could add but very little to what Mr. Dibdin had said. Indeed, if he had been asked to give a paper on the subject before them, having in his recollection the work of the committee on which both Mr. Dibdin and himself had been engaged for two years, it would have borne a great likeness to the one they had heard; and there were only one or two points to which he should wish to make any addition. Perhaps it would have been wiser if the committee had limited themselves to the matters referred to them, and only made a recommendation as to the standard of light. But they did make one on a subject nearly related to it, because it affected the actual use of the standard in testing the illuminating power of gas. It was to the effect that, instead of the gas being tested at the uniform rate of 5 cubic feet per hour at the standard burner which had been authorized for testing purposes, it should be burned at such a rate as would give from that burner a uniform light of 16 candles. Working in that way, the light might still be stated as giving the illuminating power of the gas by taking it that the quantity of gas required to give a certain amount of light varied inversely with the quality of the gas. That was substantially true. If the recommendation were adopted, there would be the advantage that the quality of the gas would be judged precisely from the consumers' point of view; for that which mattered to the consumers was the quantity of gas which would be burned to produce the desired light. It was very important that the knowledge should be as widely spread as possible that the eye was a bad photometer, and that one could not tell, by looking at the light of a burner, what was the quality of the gas. Complaints of bad gas arose nearly always in consequence of the gas reaching the burner at insufficient pressure. The effect was therefore small, and the consumer complained that the gas was bad. Actually it was not possible, over a very wide range of quality, to judge, by looking at the flame, as to the quality of the gas being burned. The actual difference was in the quantity; and this eluded attention. There were so many other circumstances which might affect the quantity that passed through the meter—the number of lights, the time during which they were burning, other burners being introduced, the use of gas for cooking and heating—which sufficiently accounted for the variation in the meter record, which sometimes caused grumbling. But among the various causes that might increase the consumption was one which could not be so easily noted, and it was that due to the variation in quality. It was for this reason that the committee, though perhaps going a little out of their way, recommended that the measure should be of the quantity of gas required to be burned in order to give a particular light. Such a mode of testing would go more nearly than the present with the effect on the consumer of a variation in the quality; and it would do more justice to those who supplied it. With the particular gas tested, a really small variation in the quality was recorded by the present method as greater than it really was. If the quality of the gas were rather less good than usual when only 5 cubic feet were burned, the amount of light underwent a considerable diminution. But if the experiment were made of trying how much the volume of gas needed to be increased in order that 16 candles should be obtained, the ratio of that increased amount would not come out nearly so large as it appeared with the present system. He might add that, as one of the committee, he tried over again some of the experiments he had made very carefully on the tolerance of variations of conditions such as might happen in actual practice. He made some of the experiments described in the paper. Placing the carburetor in warm water and packing ice upon it, and comparing the light the burner gave, he found the same result. The quantity of pentane vapor evaporated, even at the low temperature, was so considerable, and the steadiness of the light given was so great with these variations in temperature, that there was no measurable effect on the amount of light given. He had also carefully tried the effect of varying the height of the flame; and it was certainly the case that, whether it stood at such a height that the top just reached the lower edge of the screen, or whether it was nearly flaring out, the amount of light given out to the photometer was still constant. He could only re-echo the wish that the labors of the committee might not prove to have been ineffectual, but that they might at last accomplish what had been so long wanted—the establishment of a standard of light which should give constant results, and be more satisfying than the extremely uncertain candle, both to the consumer and the gas company.

Mr. J. Methven said he had been watching the behavior of the pentane standard of Mr. Dibdin during the last few months, and had compared it, in numerous experiments, against candles. He had had half a dozen operators at work, who had made 500 separate experiments; and it was found, as the result of the average, that the power of the burner was equal to 10.283 candles. Of course, it ought to be equal to 10 candles. He was glad to have the opportunity of stating the result of these experiments, because naturally an increase of nearly 3 per cent. on the 10-candle standard was almost equal to half a candle on 16-candle gas; and inasmuch as the extra enrichment of half a candle would cost the London gas companies about a halfpenny per 1,000 cubic feet, it was obvious how they would be affected by this additional value being put upon the standard. Mr. Dibdin had referred to experiments made many years ago to determine the value of the pentane standard of Mr. Vernon Harcourt. He (Mr. Methven) remembered them well; and he had the pleasure of working with Mr. Harold Dixon on this subject. He recollected also the room in which they were made, and the photometer used. He had no doubt that the character of the photometer materially affected the results. That was pretty well established. The room was not built for a photometer room; and, though large in area, it was low pitched and poorly ventilated. Supposing at that time the pentane standard was equal to one candle, and admitting that Mr. Dibdin's 10 candle burner was ten times the power of this, how was it that he (Mr. Methven) now found, by his 500 experiments, that the Dibdin burner was equal to 10.283 candles? There must be something to account for it. Of course, it might be due to the candles. But he took the precaution to use 500 separate candles, not 250 candles cut in half. Six operators were engaged, and the difference between them was very small indeed. The highest result was 10.3, and the lowest 10.1 candles. It seemed rather hard on gas companies to have to submit to the introduction of a standard which was nearly 3 per cent. too high, taking the result of his experiments with 500 candles. Mr. Dibdin seemed rather to regret that the committee had introduced any alteration in the mode of consuming the gas to be tested; but he (Mr. Methven) thought they had not gone far enough, because one very important matter in settling the question of the standards of light was to determine the photometer in which they were to be used. In the different official testing stations, there were various forms of photometers—the Evans box photometer, which had been converted and altered at the suggestion of the Gas Referees, and also the open Letheby photometer; and he believed there was a considerable difference in the results shown by the Dibdin lamp in these two instruments. His experiments were made with the open Letheby photometer, modernized, with a 60-inch bar. With regard to the effect of the humidity of the air on these flames, his experiments, made some years ago, conclusively proved that varying degrees of humidity of the air used for consuming the pentane had an effect on the light obtained from candles or a gas burner. He thought the subject had been exhausted; but he was surprised a few days previously to find, in the *Journal of Gas Lighting*, a report of some experiments by a German scientist on the effect of the humidity of the air on the Hefner standard. They seemed to have been very exhaustive, and they entirely corroborated his own results. This seemed to show that some correction for humidity should be made. It appeared that, during the different months of the year the amount of light varied to the extent of 3¼ per cent.; and in one or two months the variations were as great as 5 per cent., owing to the different proportions of aqueous vapor in the atmosphere. Without casting any reflection on the manner in which the committee had carried out their experiments, he thought the importance of the subject required that further investigation should be made before a new standard was introduced. They wanted a standard which was beyond suspicion. Candles were not reliable; and gas makers would hail the introduction of a standard which would remove the vagaries with which they had been troubled for so long.

Mr. Cadet said he had used the pentane Argand—both the 2 and the 10-candle—during the past two years as a standard for photographic

purposes. In such cases, they did not expect to work to three places of decimals of a candle: but, as far as they could observe, using ordinary care, they were unable to notice any difference when testing with the pentane Argand.

Mr. Lloyd asked if Mr. Methven could state the largest difference in the results found by the individual operators who made his experiments. These differences might, he said, be large, and yet the average of the differences between them might not be great.

Mr. Methven regretted that he had not the figures which would enable him to answer the question, but the average difference, and the mean of the whole, was what he had stated. The candles were all certified by the Gas Referees.

Mr. Lloyd said he had not got any farther, as he wanted information as to the differences between individual tests. He was himself for many years a gas examiner, but was one no longer; and so he spoke simply as one of the public. Everyone in London was interested in having a reliable standard for testing the gas he used and paid for, and the present system was an absolute farce—the differences between the standards used being so great. Even Mr. Methven said the present standard was not reliable. But the gas companies were not content to take a standard which was more reliable than the one now in vogue, but were asking for one which was absolutely perfect. If they waited for this, they would make no progress whatever. The government ought to look after the interests of the public, and this would be best done by not interfering with scientific questions, on which scientific men ought to be the sole authority. If the government would select gentlemen to fill the position of Gas Referees who would put as much knowledge and ability into the work as Mr. Vernon Harcourt did, and have a fair number of them, all scientific questions might be left to them, and they would not be bound down by Act of Parliament to something which was proved to be unscientific. With regard to the statement that the result might be affected by photometry, it simply amounted to this that any scientific operation, if not conducted under proper conditions, did not give accurate results. But these conditions should be laid down by scientific men, not by the government or members of Parliament, who did not pretend to be scientific experts.

Colonel Cunningham thought the paper had brought before the meeting a standard of light which he hoped might prove to be of much wider use than the purpose for which it appeared to have been invented—the testing of London gas. It might be used for testing the illuminating quality of other materials, such as petroleum, or for photographic exposures, or for other scientific purposes. He presumed that the material burned could be obtained beyond suspicion; but not much had been said about the medium in which it was burned, which might greatly affect the light. As regards the air, the chief differences would be pressure, heat and hygrometric quality. A considerable range of temperature seemed to have been tried; but, as regards pressure, he gathered that the only variations referred to were those found in London. Now, both in this respect, and also with regard to humidity, much greater differences were found in other parts of the world, where, perhaps, this standard might be useful. In India, there were stations at an elevation of 7,000 feet, and the standard might have to be used in a mine 3,000 feet deep. In hot countries, there was sometimes hardly any moisture in the air, whereas at other times it was perfectly saturated. To go back to the pressure, this must affect the quantity of oxygen supplied to the flame; and there were other ways in which the light might be affected by the state of the atmosphere, such as the amount of dust or fog present. If the standard of light and the thing to be tested were both compared at the same time, the conditions being the same for both would not be material; but if it were compared with an incandescent material inclosed in a glass vessel, the state of the air might affect the result a great deal. Fog and dust would also have varying effects according to the distance through which the light had to pass.

Mr. Campbell said a point which had not been touched upon was the presence of carbonic acid in the air. In July or August last, a series of researches were made in Germany on the amyl-acetate standard, and also on Mr. Harcourt's pentane standard, under varying pressures and different conditions, as to the amount of moisture and carbon dioxide; and it was found that the influence of the latter element was very great. He believed the addition of 1 part in 1,000 parts made a difference of 7 per cent. in the amyl-acetate standard. He did not know whether the experiment had been made with the pentane standard, but it seemed very important to consider it, especially seeing that these standards might be used in badly-ventilated rooms. As far as he remembered the experiments showed that the atmospheric pressure was not of importance.

Mr. Grafton referred to some former experiments by Mr. Dibdin, which seemed to show that his light was equal to 16.7 candles by Mr. Harcourt's 1-candle standard and Mr. Methven's 2-candle standard, while these two agreed in returning the gas as 16.3 instead of 16.7 candles. Mr. Dibdin put down the 0.4 difference to variations in the candles, but he (Mr. Grafton) took it that this was included in the average, and that 0.4 was a figure which ought to be recognized, since with 16-candle gas, it made Mr. Harcourt's standard 2.4 per cent. too high, which would be exaggerated ten times when they came to Mr. Dibdin's lamp. He had conducted a large number of tests, about 3,000, and he could not get it to average 10 candles. He, therefore, thought there must be something radically wrong somewhere. He had also to complain that the chimneys for Mr. Dibdin's lamps were not cut off at right angles to their length, and, therefore, canted over when set up. He had no other fault to find with the lamp, except that it was too powerful.

Mr. T. S. Lacey said he had used the Dibdin standard in his ordinary daily work ever since it was first brought out, and found it very convenient and accurate. The paper was really on a standard which was constant, and he did not think that they need discuss whether it represented any exact number of candles. The amount of light given by it was definite, whereas that from a candle was not. No one could say what an average candle was, and one could only get at an average by testing some thousands of them. By this standard they would be able to actually test candles. The value of a standard which was invariable was apparent to everyone, but he thought it would be a great pity to make a 16 candle standard lamp. The 10-candle standard was very handy, and one could take the readings direct from the bar without calculation, but this could not be done with a 16-candle standard, unless one had a special photometer-bar. He considered the committee were thoroughly competent, and he hoped the question would not be re-opened.

Mr. Hearson asked if pentane could be readily obtained, and if there would be any difficulty with regard to its carriage, on account of its inflammable nature.

Mr. Dibdin, replying to the discussion, said he had not found any difficulty in procuring pentane, and it generally came by carrier. It was no more dangerous than ordinary benzolene or ether, or many other things which were systematically conveyed about the country. Taking, in order, the points raised. Mr. Methven had stated that an average of 500 experiments gave a value of 10.283 candles for the pentane 10-candle standard. Against that he had to place his own experiments which numbered about 2,000; while those made by the members of the committee and others must have amounted to about 10,000. So that there were about 12,000 against 500. He could not cavil at Mr. Methven's results; but an average derived from 10,000 or 20,000 experiments must outweigh an average of 500. The question of photometers could now be settled without going to Parliament, because the Gas Referees had full powers, and he believed it was understood, by all persons interested in the question, that when the standard was settled the Referees would, once for all, prescribe the photometer. His own experience was that, if a photometer were well ventilated, it did not matter whether one had a bit of wood at the back or a velvet curtain, or something in front or at the ends, so long as the eye of the observer was screened from lights, and reflection from extraneous surfaces on the screen was avoided. The cabinet work did not matter. He preferred to burn lights in the open, but this was immaterial. However, to surround the lights with upholstery did not seem to him the best way of proceeding. When they had candles burning in a heated box, with insufficient ventilation, they could make them do whatever they pleased. This was exactly what had been done in some of the experiments referred to by Mr. Grafton. In some of his results, he obtained an average of 16.3 candles as the value of a certain flame with the Methven 2-candle screen, as against 16.7 candles as an average of all the results with candles. But this average of 16.7 was produced by including certain results obtained in a room purposely heated to a temperature of over 90° F.; and the candles behaved in such a way, owing to the rapid volatilization of the sperm, that they began to smoke, and gave less light. Thus the amount of the sperm consumed was made to appear higher, and in many cases the 16.3 average, when tested by the candle itself, appeared to be up to 18 or 19 candles. He therefore had excluded all the results which came over 17.5. Thus the Harcourt lamp, the Methven screen, and the candle fairly agreed, excluding results which were obviously incorrect—the reason being known in many cases; and he considered he was quite justified in doing this. He was obliged to Mr. Cadet and Mr. Lacey for their support. Colonel Cunningham seemed to have a notion of carrying a standard of light all over the world. This was a

grand idea; but the Board of Trade Committee recommended the adoption of his standard simply as a working standard for testing gas in London—not as an absolute unit of light to be used everywhere. His own opinion was that it was the best standard for any place under present known conditions. What would be the variation at an elevation of 7,000 feet, or down in a mine, he had not had an opportunity of trying. But Mr. Vernon Harcourt had made some experiments with the 1-candle unit on the top of Ben Nevis, against the light of an incandescent electric lamp, and he believed that the variation was very little, if any. If this were the case, probably the same result would be found with the 10-candle standard, as the same argument applied. The effects of dust and fog were eliminated to a great extent by the fact that the distance between the standard and the light to be tested was usually very small, so that the fog would have to be considerable before any readable difference would be introduced. Mr. Grafton also raised the point that his chimneys were not always nicely ground at right angles. But if anyone chose to purchase something which was not what it ought to be, he must take the responsibility. He was glad to hear Mr. Lacey recognize the fact that the committee had done their best to arrive at a practical solution of the question. Altogether, he thought the tone of the discussion was such as to justify the decision at which the committee had arrived.

The Chairman then proposed a vote of thanks to Mr. Dibdin. In doing so, he said that any body who had ever had to do with photometry by candles would agree that the sooner this method was got rid of the better. They must recollect, however, that they had to educate members of Parliament, who were the most ignorant people one could meet in a day's march. If they could get them to vote for the introduction of a proper standard, no one would be more rejoiced than himself. He could not say that he looked upon the Dibdin standard as a scientific one. He thought the unit of light would eventually have to be an incandescent solid of some kind. But for purposes such as gas testing it was the most convenient and practical one at the present time. Everyone who had watched this question as he had done for a great many years would testify with what care Mr. Vernon Harcourt had worked out the details of the pentane standard. In the original form it was a naked flame; and he must confess that he liked an open flame better than one inclosed in a chimney, because there was an amount of uncertainty about the absorption of glass which one could not be sure of finding out correctly. It might absorb or it might not; and it depended upon the maker of the glass what kind of chimney they had. This might make a slight variation, which would materially interfere with the results for scientific purposes. Col. Cunningham's remarks were worth attention, and he (the Chairman) should have been glad of a standard of light at an altitude of 10,000 feet, where the air pressure was only equal to 20 inches of mercury. But he did not know what would happen with the pentane standard under such circumstances—very probably it could be so regulated as to be satisfactory. The *Journal* article to which Mr. Methven referred was an excellent one, and well worth reading. One photometer ought to be as good as another if it were properly used; it all depended on that. But if they used a grease spot, there were so many pitfalls open, and so many precautions had to be taken to prevent error, that he preferred Mr. Vernon Harcourt's method of screens. But there was not time to enter into this question, or some others he might have referred to. He hoped the discussion might help to educate members of Parliament, so that there might soon be a satisfactory standard for testing London gas.

The vote of thanks was unanimously accorded.

A Proposed Improvement in Arrangement of Service of Night Watchmen.

Mr. C. F. Simonson, General Inspector of the Hartford Fire Insurance Company, at a meeting of the officers and special agents of the Company, delivered an address, the portions of which we quote concerned improvements in the method and manner of "night watch" service. Mr. Simonson said:

I have been led to give considerable thought and study of late to improvement in the watch service for large buildings, mills and factories in which we are so largely interested, owing to the many instances which have come to my notice of the unsatisfactory class of service now in vogue, and the number of fires resulting therefrom, and I deem the matter of sufficient importance to bring it before you to night, in hopes that by united effort we may institute a reform which will not only prove of great benefit to the interests we serve, but to those poor fellows who have to work while the rest of the world sleeps—the night watchmen. From my earliest field experience and inspection of special hazards, I have noticed the distrust which manufacturers and other employers have for night watchmen, many preferring to leave their buildings wholly unprotected rather than to employ a man to watch at night; and others are only induced to employ such a person by the almost unanimous demand made upon them by the insurance companies and allowance made therefor of from 25 to 50 cents in all rating schedules.

I would like to offer what I consider a solution of this problem, and a plan of employing two watchmen at the expense of one. This, if adopted, would, I believe, remedy to a large extent the defects found in the present system, and considerably raise the standard of efficiency of the average night watchman.

First let us inquire: Why is it that watchmen are so universally mistrusted? They leave their homes at 5 or 5:30 and reach the factory at 6 o'clock. After looking over the plant and seeing that everything is safe and in order, they commence their rounds at 7 o'clock, and make half hourly or hourly trips until midnight, when they eat their lunch. They then continue the rounds until 6 o'clock in the morning, when they start the fires under the boilers and get everything ready for the day's work, and are relieved by the engineer at 7 o'clock. When we consider that this work of 14 hours is done at night, when the city is at rest and the quiet is only relieved by the sound of his own heavy dragging footsteps on the floors, through dreary and gloomy rooms, poorly ventilated and dimly lighted by his solitary lantern, every night in the year, through cold, chilly rooms in winter and hot, stuffy nights in summer, when it is natural for all of us to desire rest and sleep, is it any wonder that the watchman is found inefficient, careless and even criminal in his disregard for the interests of those by whom he is employed.

He goes home to breakfast and tries to sleep. The bustle and noise of the city are upon him; the noise of wagons in the street, of children playing, dogs barking and household duties performed by other members of the family, all disturb his rest, and he rises in the afternoon illy prepared for his monotonous night labor. He goes to work with a heavy heart, with no courage or strength to support him; he tries to catch a few minutes' sleep between rounds, and is only startled from it by the sound of heavy blows on the door, made by a policeman or runner from the Central District Watch Office, where it has been discovered that he has missed his call, or he mechanically does the work wholly unconscious of what he is doing, he walks in his sleep and fails to discover the fire in its incipiency, and is frequently found in the ruins the next morning.

At the Phelps, Dodge & Palmer shoe factory fire in Hartford a few years ago, the watch clock showed that the watchman had passed through the floor a few minutes before the fire was discovered by some one in the street who gave the alarm, and the watchman had no knowledge of it until the arrival of the engines. This fire cost the insurance companies over $20,000, and could undoubtedly have been prevented if the watchman had been alive to his duty, as it must have been smouldering and burning when he passed through the room. The old red planing mill on the river burned some years ago and the remains of the watchman, his dog, lantern and watch clock were found together in the center of the mill, showing that he evidently went to sleep and something overturned the lantern, setting the shavings on fire and burning the mill.

At a recent fire in the machine shop of McCormick's harvester works, Chicago, the watch clock showed the watchman had been through the shop five minutes before the fire was discovered by others and had failed to notice it. Mr. F. Herold, of the Herold & Sons' furniture factory in this city, admits that his watchman sleeps at night, but says he will make no change because they all do it, and he has tried several. His watchman has a habit of waking at the proper time to push the button but has frequently been found asleep. Some watchmen sleep between rounds, employing alarm clocks and dogs to wake them at the proper time. One ingenious fellow constructed a bench on which he would seat himself astride, so that if he went asleep he would fall over and be wakened to make his rounds.

Superintendent Shepard, of the Fire Patrol, says that they frequently find watchmen asleep at the stockyards during the 15 minutes' relay time at midnight, particularly on hot summer nights. At a large packing house in the stockyards it was discovered that the watchman left the heavy fire doors open between the chill room divisions, and upon being followed he was discovered asleep, lantern in hand, leaning against the door casing nearest his box, which he had failed to pull. At the United States warehouse a short time ago the watchman slept and missed his call. Awakening and finding that he had overslept, he went to the basement, spilled the oil on the floor, set it on fire and turned in the alarm. He showed a burned coat to prove his statement that he had been occupied in extinguishing the fire, which did not save him, however, after an investigation, and he was discharged. They will tamper with watch clocks and with the key clocks; it is easy to have a key made containing all the notches, so that they can make the records

at one time and sleep the balance of the night. With electric clocks they have been known to destroy the insulation and effective working of the apparatus for the time being.

At the recent fire in the Chicago Forge and Bolt Company's works, the watchman had hard work to get out of the building alive, and Chief Sweenie tells me the firemen frequently have to take the watchmen off the fire escapes. It is evident from the above that watchmen are of little benefit in a building at night, and that even the most perfect watch service will not compel a man to stay awake when nature demands sleep.

It is cruel and inhuman for us to exact such a service from any man, and in my opinion earnest effort should be made to lighten their burden by advocating the following plan: Select two men capable and fit to be watchmen, sweepers or helpers; let one begin his shop work at noon; when the factory closes at night he takes a round until satisfied that everything is all right and in proper shape, then eats his supper, which he carries with him, and enters into his regular rounds of watching. He watches until 11:30, reaching home before midnight. The second man relieves him at that time and watches until 6 A.M., when he eats his breakfast, starts the fire and opens the factory for employees at 7. Having had breakfast and the factory open, he is ready to go to his shop work until noon, when he goes home and returns at 11:30 that night. In this way the expense would be no greater than employing a sweeper or helper during the day and a watchman at night, and each would have one-half day and one-half night at home. It is plain to anyone that a man with these hours at home could get the requisite amount of sleep. Change about could be had each week, so that the man who had the first half of the night to watch one week, could have the second half the next week, and *vice versa*.

A man that works nights and sleeps days becomes a machine instead of a live man, and it is a common thing to find buildings badly on fire with the watchman taken out suffocated and nearly dead, and in all the big fires in Chicago at night watchmen have been employed. In the Pinkerton watch service the men go on at 7 P.M. and come off at 10; go on at 1 A.M. and come off at 5.

In the watch tower fire service, from which an average of 400 alarms are sent out each year, the men are relieved every two hours, so careful are they that they must not sleep. This system has been tried for the past two years by Charles F. Elms Engineering Works and Lyons & Healy organ factory of this city, who recommend it highly and say that nothing could induce them to change back to the old system. No man can work continuously 14 hours at night, and have 10 hours at home during the day for eating and sleeping, and be fit for work of any kind, much less that of watching and guarding millions upon millions of property values in which it may be the safety of cities is involved, and I earnestly recommend that this system of watching be proposed and its adoption secured wherever possible.

Dielectric Strength of Oils Under Alternating Potentials.

By Elihu Thomson.

In the course of tests made under the direction of the writer some two or three years ago, the interesting fact was noticed that the striking distances of high potentials in insulating oils were in some way variable with the frequency of the current or potential waves, or upon the time during which electric stresses existed in a given direction through the medium.

This relation has been confirmed by other and later experiments. The general effect was found to be that discharges at low frequencies are capable of puncturing mineral oil layers up to from one third to one-half the thickness of an air layer required to just resist puncture by the same discharges, while with high frequencies of equal striking distances in air an oil layer of one-thirtieth to one-sixtieth of the thickness of the air layer was sufficient to prevent discharges. At frequencies such as 125 per second a potential which would give one-half inch spark in air may puncture from one-third to one-fourth inch of oil between the electrodes, while at frequencies of 50,000 to 100,000 a layer of oil of one-fourth inch may resist puncture when the spark in air is as much as 8 inches. The high frequencies experimented with were such as were given by condenser discharges over an air gap including a primary of a few turns, with a secondary of a single layer of some hundreds of turns immersed in oil. The discharges, in such case, are not continuous waves, but a rapid succession of oscillatory discharges with dead intervals of periods of inactivity intervening.

The effect of carefully drying an oil was found to increase its insulating power. This was also true to a marked extent when careful filtering was resorted to, a decided decrease of striking distance through the oil with the lower frequencies being observed. It follows from this that all oil used in insulating for high potentials with low frequencies should be kept clean and homogeneous, and free from floating particles.

Variations of temperature of oil did not, in the experiments made, greatly affect the striking distances for a given potential. The general fact, however, that with high frequencies the insulating power of oil layers is, as measured by the striking distance in air relatively to that in the oil, far in excess of such insulating power for low frequencies, seems to be unaffected by the dryness, clearness or temperature of the oil used.

It appears probable, also, that with partially conducting liquids like alcohol and water the behavior with high frequencies is more like that of a true dielectric insulator than with low frequencies. As an interesting fact in this connection, it may be noted that a high potential high frequency coil capable of yielding spark torrents of over 30 inches of air gap between its terminals, still maintains its discharges even when shunted by a glass tube 1½ inches in diameter, containing ordinary water, and long enough to bridge the gap.

It is difficult to account for the differences in the effects obtained with high frequencies from those with low frequency alternating waves. A time lag in the establishment of the full dielectric stress or full electrostatic field in the oil might account for the phenomena. According to this hypothesis if two electrodes under oil, separated a certain distance, instantly acquire a difference of potential, this potential would not with equal rapidity strain the oil to the full extent. It might be assumed that the polarization of the oil molecules requires time. Or, it may be that only such part of the electrostatic field as is due to the ether is first established after electrification, and that the increase of such field due to the molecules of the substance, such as the interposed oil, is subsequent to the former.

If this were so the establishment of an electrostatic field at high rates in oils would present analogies with the case of magnetic fields and iron or metals.

It would also follow, if the supposition of a lag as above be true, that in condensers such as those using oil as a dielectric, the capacity would be less the higher the frequency. Again, if any such lag as is assumed exists, it would probably vary with different insulating media, and it may depend upon the molecular state, as viscosity, for example. Observations of the oil space between the immersed electrodes, by polarized light, could probably be used with certain media to detect any differences in time of establishment of electrostatic stress with different frequencies, it being well known that under high stresses certain insulating liquids become strongly affected in their optical properties, with rotation of polarized beams of light traversing them. If the optical effect noticed should be less in the case of high frequencies than with low rates, it would indicate a probable lag of the kind assumed. Similar studies using solid dielectrics like glass, mica, etc., would also be desirable. Should the results be negative it would be necessary to attack the problem in some other way.

M. P. Jaret, about a year or more ago, in a communication to the Paris Academy of Sciences, gave the results of his investigation of the properties of mica. He found that it did possess, with rapid oscillations, what might be termed a dielectric hysteresis. Such a property may exist to a more marked degree in oils.

In the tests of the power of oil layers to withstand puncturing by high potentials, a curious effect was noticed, which was that discharges under oil passed far more readily between balls than between sharp points. In other words, with any given difference of potential between the immersed electrodes, as measured by the air spark obtainable, pointed electrodes could be brought much nearer than balls without provoking puncture. With balls of ¼ inch diameter as terminals, and with low frequency (125) potential differences, ranging from 100,000 to 150,000 volts, the space between the points could be one-quarter that between the balls. The ratio between the length of spark in air and between sharp points in oil was 10 to 1 at 10,000 volts, and 8 to 1 at 15,000, while with balls these ratios fell to 2.4 to 1, and 2 to 1 respectively. When flat plates were substituted for the balls the striking distance in oil was still further increased as compared with the distance with points. The seemingly anomalous action of points under oil, so different from their action in gases or air, is certainly curious, and the usual injunction to avoid points and edges as conducive to electric discharge does not seem to apply in such media as oil, at least when the potentials are alternating and at ordinary frequencies.

In experimenting with discharges in oil, uniform results are only to be obtained by using carefully filtered oil, as ordinarily they contain

suspended particles, fibers, etc., which appear to bridge the space between the electrodes and provoke a breakdown due to the non-homogeneous character of the dielectric. It is also necessary to discard oil after arcing has once occurred through it, as it will have become much weaker owing doubtless to the fine carbon particles set free and which remain floating, ready to be drawn into the space between the electrodes, thus giving rise to loss of homogeneity of the medium.

The Safe and Economical Management of a Steam Plant.

By Mr. Chas. E. Garlick, M.E., in the *Safety Valve.*

Safety and economy should be the watchword of every engineer in charge of a steam plant. It is not necessary at this time to call attention to the dangers connected with the operation of a steam plant, as the all-too-frequent boiler and flywheel explosions, and the loss of life and limb, due to uncovered gears, etc., etc., point to the necessity of being always on the alert, and the need of education in this particular direction.

The engineer in charge of a steam plant of any considerable size will find that eternal vigilance is the price of safety. Volumes upon volumes have been written as to the safe and economical management of a steam plant, and yet a hint here and there to the engineer in charge, or who is about to assume charge of a steam plant may be of interest.

Taking up the question of safe management first, because it is the most important, and starting at the boiler room, the foundation of all manufacturing plants, we will make an inspection of same and see what can be done to guard against accidents.

Choose a Sunday, or some time when the plant is idle. There is no fire under the boilers. The walls and other parts of the furnace are comparatively cool. All ashes and clinkers have been removed, and the boilers thoroughly washed out. Donning your overalls, and taking hammer, chisel and short-handled broom, you go in at the fire door. At the first circular seam, stop and brush off the soot; a disagreeable job, we know, but *you* must know the condition of the boilers from a personal examination. Others not having to assume the responsibility might, owing to the disagreeable nature of the work, shirk it. You look for fire cracks, and not finding any, move on. If any are found, make a mental note of the number and their extent. If any run back of rivet and into plate, you will drill hole at end of crack, and drive a rivet in hole. This will stop crack from extending any further into sheet. As you go over bridge wall, note its height. The sole purpose of a bridge wall is to keep firemen from pushing coal over into the combustion chamber. Heat will naturally rise without any wall to guide it, and a high bridge wall is very apt to cause your boiler to leak at the seam. Examine closely your mud drum, if the boiler is equipped with one; especially at the leg and reinforce plates. See that there is no brickwork around drum that will prevent a thorough examination being made, as mud drums are apt to deteriorate rapidly from external corrosion.

Move on to the end of the boiler and examine tubes or flues for leaks. If there is an accumulation of scale around the end of tube or flue, clean it off and roll or caulk, as the case may be.

Examine the blow-off valve and pipe, especially close up to flange, or reinforce plate, as there are many instances on record where the pipe having become weak and thin at this spot, due to the cutting action of a small leak, has broken off, and not only injured the boiler attendant, but caused considerable money loss. Now coming out, and having made a record in a book prepared for that purpose, as to the condition of fire bed, bridge walls, circular seams, blow-off pipe, valve and tubes or flues, you will then make an internal examination of the boiler. First examine the bracing; see what surface has to be stayed, the number of stays, their thickness and condition, etc. Look closely on crow feet where the strain comes between rivets, and see if the contraction or expansion of boiler has produced any cracks. Having finished your examination of braces, turn your attention to the sheet for corrosive action. At or near the water line is the most probable place to find corrosive action, but some acids being heavier than water, sink to the bottom, and their effects may be found there. If the boiler is found to be pitted, and the pits very close and deep, or corrosive action covers considerable space, it should be attended to at once, the remedy being a patch or entire new sheet. But if pits are few in number, and widely scattered, they are not dangerous, as a rivet properly placed will stop any leak. A plate showing corrosive action should be drilled in the thinnest place, and this can be taken as the thickness of shell when figuring to ascertain the safe working strain of boilers. If pits or corrosive action are due to any acids in water, something must be done at once to neutralize the acids and check the pitting or corrosive action.

You will note the condition of fusible plug and see that it is not covered with scale so as to make it inoperative should water from any cause become low. Coming from the boiler and noting in your book any defects and the probable cause of same, you will then turn your attention to the outside connections. By all means have a water column on boiler and let connections to same be large, and such that when cleaning out, water can be run through them and all dirt removed.

The safety valve and steam gauge should be examined and boilers should be made to blow off every day at least once, and when doing so note that steam gauge and blow-off register the same. Having completed your examination of boiler or boilers, give your attention to the water supply. As a matter of safety and to insure the steady operation of the plant, there should be a tank or reservoir of sufficient capacity to supply your boilers with water for at least one honr, where the source of supply stopped. Examine now your pump or injector. From an economical point of view a pump is the best to supply the boiler with. Attention should also be given to your heater. With some of the closed heaters the same rules regarding the safety of a boiler apply to the heater.

Having completed your examination of boilers and appliances, examine steam line and see if the top connections on boilers are rigid and stiff joints; if so, at the earliest opportunity have swinging joints made (corrugated copper joints to take care of expansion and contraction will be found excellent here and a great preventive of leaking joints). See that main valve on top of boiler or boilers is in good condition and could be closed tightly in case it became necessary to shut off steam here. Following your line on, see that expansion joints, if there are any, are all in working order, and if of the telescope pattern, see that they are well packed, and where using expansion joints, see that your line is properly anchored. If there is a receiver of any considerable size in line, examine it for internal and external corrosion, and the bracing, same as you did your boiler.

Having arrived at your engine, see that all moving parts are guarded so that no person could be injured by falling in or against them, a proper railing around flywheel pit, all gears covered, belt shifting arrangements in good order, no grease spots on floor, or articles lying around. Owing the frequency of flywheel explosions, the wheel should be examined quite often, and from any of the engineer's books of reference you can obtain rules whereby you can ascertain the safe speed at which it may be run.

In some places an automatic arrangement, whereby the engine can be stopped should it exceed a certain speed, is as a matter of safety almost indispensable.

Now, having completed your examination and erected the proper safeguards where needed, and made a full and complete record of the condition of boiler pumps, steam lines, engines, etc., an examination similar to the one just finished should be made each month. You should ascertain the material of which your boiler is made, and the tensile strength, whether single or double riveted, thickness of material, diameter of boiler, and from this data you can, by taking the U. S. rule, quickly ascertain the safe working pressure that can be carried on your boiler, and do not let it exceed this. If you employ firemen, it is well to have printed rules for their guidance, made and put up in the boiler room in some conspicuous place, as having these orders always before them gives them no excuse for disobedience. Be particular as to the manner in which steam is turned into main line. When necessary to do this it should be done slowly and carefully. It is always best to raise steam on boilers with all valves open to main line. During leisure moments decide what you would do if your blow-off pipe should burst or your engine get beyond control, and many other accidents that may occur and call for quick action.

The time will come when, uncertain as to the safety of boiler and engine, a feeling of doubt will arise as to whether it is safe to continue running. Ever err on the side of safety, as a shut-down will mean but a money loss, while a boiler explosion or wrecking of an engine may not only result in a loss of life, but injure your reputation as an engineer beyond recovery.

We will now turn our attention to an equally interesting subject, namely, how to attain the highest possible economy with the plant under our charge. Do not say "my plant is old and run down, and the the owners will not buy anything new, and I cannot do anything but go on as I have in the past." A plant of that description is the kind that a bright, energetic engineer is looking for, by which he may make a reputation. Here, as in the former case when looking to the safety

of the plant, we will commence our work at the boilers, and nothing will give you more true knowledge of what can be done in a boiler room to attain economy than a personally conducted practical evaporative test, and it can be made by the engineer with little or no extra expense, and with the appliances at hand, and will tend largely to increase the engineer's knowledge of economy, and point out many changes that can be made that would be beneficial to all concerned. To make a practical test of all that is required is a few oil barrels, a couple of thermometers, one registering 212° F. and the other 600° F., a platform scale, and a couple of boxes in which to weigh coal. Erect near your pump or injector a platform about 4 feet high and sufficiently large and strong to hold a man and two barrels of water. Take 1¼-inch nipple and valve and a common oil barrel, place them together on scales. Their weight will be found to be about 80 pounds or less. Now run water in the barrel until it weighs 480 pounds, or 400 pounds more than the valve, nipple and barrel weigh. This weight of water will fill the barrel to about 2 inches from the top. Cut off 2 inches from the top of one stave, or level with water's edge. You now know that if you fill barrel until the water runs out that space left by sawed out stave you have 400 pounds of water in barrel. Empty the water from barrel and bore a hole in the same at the bottom sufficiently large to admit 1¼-inch nipple. To this nipple attach the valve. Arrange two barrels in this way and place on platform. Under platform place one barrel in such a position that water can be taken from either of the barrels on the upper platform. Make your connections to injector or pumps, as the case may be.

With this arrangement it is only necessary in making tests to keep a record of the number of barrels of water used. To ascertain temperature of flue gases, take a piece of 1¼-inch pipe, say 12 inches long, have one end plugged, attach a wire to it so that it may be suspended in breaching of stack, fill with cylinder oil, and when making a test remove from breaching once every half hour and drop into the oil your 600° F. thermometer. This will give you the temperature of waste gases. To weigh coal, have a box of convenient size for two men to handle, made with handles at either end. This can be weighed, filled and placed in another box made for the purpose and located near the boiler. If you desire to obtain the draft of stack, get a glass tube, heat it, and bend it in the shape of a U. To one of the legs of the U attach a small rubber hose, to the other end of which is a small section of ¼-inch pipe. A hole is cut in stack and section of pipe inserted, the U partly filled with water, and the difference in height of water in the respective legs, in inches or parts of inches, is the draft in the stack. Should you wish to ascertain the moisture in the coal, take 10 or 15 pounds from the pile, place in bag or iron box, carefully weigh same, and then place on top of boilers for 24 hours. Weigh again, and from this data can be obtained the percentage of moisture in coal.

Now, everything having been arranged the night before (and blow-off blanked if found necessary to keep it from leaking), at 7 o'clock in the morning test is started by measuring the height of the water in gauge glass (water will be brought at same level at close of test, or allowance made for same). Note carefully the condition of fires, see that all ashes are removed from ashpit, and then weigh carefully all coal that is used. Keep an account of the number of barrels of water used, and let your test continue for 10 hours if possible, taking temperature of flue gases every half hour, also temperature of water at barrels and after leaving heater (if one is used). Make your test in such a manner that at the end of each hour you may know amount of coal consumed and water evaporated. Experiment as to the proper amount of draft to be given, and note results. When closing tests, bring fire, height of water, etc., to as near the same conditions that they were when first starting as possible. Weigh carefully ashes that are made. As soon after close of test as convenient take data obtained, and compute amount of coal burned per square foot of grate surface, per square foot of heating surface. Evaporation per pound of coal, actual conditions; amount of water that would have been evaporated had your feed water been 212° F. Also amount of water evaporated per pound of combustible during the test. Note anything in your record book that occurs of an unusual nature connected with the test. Keep this data, as at some future time, after you have made changes that this test shows to be necessary, you may wish to make another test to see how much the change has added to the economy of the plant, or if you change coal, another test will show the relative value of the coal as a steam maker. When changes that the test show to be necessary, to make the plant more economical, have been made, and results proven by another test, give your attention to the heater, and bear in mind that every 10° F. that you add to your feed water by means of heat that would otherwise be wasted, means approximately a saving of 1 per cent. of coal. If your feed water to boilers is not already heated to or above 200° F., you can surely find some way to save here. If your exhaust is used for other purposes, can you not arrange a coil of pipe in smokestack, and have water go through it before going to boiler? There is usually some waste heat that can be used for this purpose if the engineer wishes to do so. Having gotten your feed water to boilers heated to over 200° F., see next to your steam lines, that there are no leaks getting larger and larger each day, thus becoming a source of considerable loss. If you find leaks, repair them at once. If your pipes are not covered with some good non-conductor, they should be; but do not go at once to your employer and tell him the pipes should be covered—wait until you have made some saving in the plant elsewhere, and then study up about the losses of heat due to radiation from uncovered pipe. Find out what the loss is per square foot of pipe at a certain pressure; what it will cost to cover the pipes; how long the covering will last; what the saving will be should the pipes be covered. Do not go to the owner for the covering of the pipes, or in fact for anything else, until you have studied the question and know you can answer intelligently every question he may ask. Show him by your answers that you have a thorough knowledge of the question, and you will get what is necessary, or at least show your employer that there is an opportunity to save money if he wishes to embrace it.

Now having arrived at the engine, remember that while engines may differ in kind, they do not differ in principle; that an overloaded engine is wasteful because cut-off is late; time for expansion short, and consequently steam is released at high pressure. An increase of boiler pressure (if it can be done with safety), or an increase in speed of engine, are both conducive to economy in an overloaded engine. An underloaded engine, or one too large for the work that it is called upon to do, is even more wasteful than an overloaded one is when engine is running non-condensing, as in many cases the power required to overcome atmospheric pressure is equal to the mean effective pressure required to do the work. Were additional work thrown on engine and mean effective pressure required to do the work raised, the amount of energy required to overcome atmospheric pressure remains the same. Every engineer should provide himself with an indicator, and some good book on steam engine economy. When indicating your engine, should your card show a negative loop in expansion line, and no other work can be thrown on engine, you may reduce speed of engine or lower boiler pressure; either will add some to economy of engines. Your admission line and steam line should be at right angles to each other. Your expansion line very near follow Marriott's curve. Leaking valves and pistons are a fruitful source of loss. Care should be taken that the exhaust is not cramped, the back pressure being made as small as possible. Sufficient compression should be given to make the engine run quietly, and no more. Usually a high initial pressure and a low terminal pressure denote economy. It is important that each engineer keep a log book, and equally important that the log book should be a truthful chronicler of facts. Note each day in this book the amount of coal used (if possible to obtain this data.) Any incidents that occur, break-downs, if any, and their probable cause, so that they may be guarded against in the future. Note amount of different kinds of oil used, the date of packing engine, also of cleaning boilers, which should be quite frequent. In fact, your log should chronicle anything that is interesting in connection with your plant and that goes to make up expenses of same. Bear in mind that oil, waste, packing, supplies and labor all represent money, and that your success and reputation as an engineer all depend upon the safe and economical management of the plant under your charge.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Indianapolis (Ind.) Gas Company has contracted with the Consolidated Coal and Mining Company, of Cincinnati, for 26,000 tons of Youghiogheny, second pool, gas coal, for delivery on demand during the current year.

THE Directors of the Washington (D. C.) Gas Company have perfected the following executive organization: President, John R. McLean; Secretary, Wm. B. Orme; Treasurer, John C. Poor; Assistant Secretary, Sanford N. Whitwell.

AT the annual meeting of the New York and Cleveland Gas Coal Company the following result was reached: Directors, Henry Phipps, Jr., Frank Semple, W. H. Berger, Thos. M. Carnegie, J. T. Hamilton, John Walker, Jas. J. Donnell, J. D. Lyon and W. P. De Armit; Pres-

ident, W. P. De Armit; Secretary, C. L. Dixon; Treasurer, Frank Semple.

MR. JOHN DODD, senior partner in the Cleveland (O.) Gas Meter Company, has withdrawn his interest from that concern.

A RESOLUTION introduced some days ago in the First Branch of Baltimore's City Council provides for the appointment of a joint committee to inquire into the possibility of securing a lower gas rate for that city. The resolution further provides that the committee shall, in its investigation, ascertain the amount of stocks and bonds owned and issued by the Consolidated Gas Company, and the taxes it pays to the city; also, if any abatement in its assessments have ever been made by the Appeal Tax Court, and, if so, why they were made.

THE following petition, now before the Legislature of Boston, rather goes to show that an earnest attempt to consolidate *all* the gas interests of Boston and its suburbs is underway:

"The undersigned respectfully represents that there are divers gas and lighting companies in the city of Boston and its vicinity, each doing business with a separate capital stock.

"That there is necessity that the same should in some way be consolidated.

"Wherefore, your petitioner prays that such measures shall be enacted as will compel or authorize such consolidation on an equitable and just basis.—HOMER ALBERS."

THE following is the text of the decision of the Board of Gas and Electric Light Commissioners in respect of the petition and hearing for a revision of the gas rate at Malden and Melrose, Mass.:

"This was a petition by the consumers of the Malden and Melrose Gas Light Company for a reduction in price of gas.

"A public hearing was given at Malden, at which the petitioners and the Company were represented by counsel. Although the city of Malden is not a customer of the Company, the City Solicitor, pursuant to a vote of the City Council, was heard in its behalf and in favor of the petition.

"In addition to a careful consideration of the facts submitted at the hearing, and in response to the request of the petitioners, the Board has made a thorough examination of the affairs of the corporation, its history, methods, present condition and immediate necessities.

"The Company began operations in 1854. It has never watered its stock, and although nearly one-third of its present capital has been issued at a price much above par, it has rarely exceeded a 6 per cent. dividend, all other profits having been applied to the maintenance and development of the plant. It is now carrying a considerable debt, the proceeds of which have all been applied in the same direction. It is situated in a rapidly growing territory, with a mileage of mains exceptionally large for its output and the number of consumers. While this extent of pipe is a substantial advantage to the community and seems to be no greater than the public convenience demands, it nevertheless sustains such an abnormal relation to the output as to materially increase the cost of supplying its gas. A study of the plant and its operation reveals the necessity for an immediate large expenditure for extraordinary repairs and extensions, some of which have already been too long delayed. The interests of the community imperatively demand that these alterations and extensions be promptly undertaken, and the investigation of the case has forcibly impressed this fact upon the management. While the new extensions demanded may properly require the aid of new capital, the alterations, so far as in the nature of repairs, although extraordinary in character, are a legitimate and necessary charge upon income, and in most successful companies provision for this is made by a regular annual appropriation and accumulation out of receipts. In a former case, after carefully examining the origin and growth of that part of the present debt then existing, the Board decided that it constituted a proper demand upon the income and ought not to be represented by new capital. No fair and just determination of the question of price can be complete without some consideration as to how the cost of these alterations needed should be met and the debt extinguished. A fair price ought always to be ample, with skillful management, to provide for every expense for current operation and maintenance or depreciation, so that the burden of fixed charges shall be restricted to those imposed by necessary capital. The public interest demands, not only the lowest reasonable present price, but the adoption and steady pursuit of such a policy as will be most likely to secure the lowest possible price in the future.

"These propositions imply a high standard of efficiency in the corporate management, yet one that is evidently just if the Company be continued in the monopoly of an important public service. To finally and justly determine whether such standard has been fully maintained must often be a question of serious difficulty, but the facts revealed in this case raise a strong presumption that the Company has in some measure failed to reach it. Any reduction which under such a policy might have been readily accorded may now be justly required. These are the controlling considerations in this case.

"The Board has endeavored to name a price which shall compel the Company to employ the strictest economy and the highest technical skill to fully meet, in its own and the public interest, the responsibilities which its present condition imposes.

"The Board, therefore, recommends that from and after the first day of January last the net price charged for gas supplied by the Malden and Melrose Gas Light Company, shall not exceed $1.50 per 1,000 cubic feet."

THE managers of the Charity Fair, Columbus, Ga., are profuse in their acknowledgments of the liberality of the Gas Light Company of that city, which is as it should be; for the Company caused to be placed in each booth a Welsbach lamp. In the same enterprising spirit the Company furnished gas heaters for maintaining at comfort the temperature of the hall, and installed in the kitchen a large cooking range. All the gas used for heating and cooking was furnished by the Company free of charge.

THE Committee on Gas and Electric Lights, of the Columbus (Ga.) Council, has recommended a trial of Welsbach lamps for street lighting, and with that object in view the Gas Company will place three lamps on Front street, between 12th and 13th streets, as per the suggestion of the Committee.

THE Berlin Iron Bridge Company, of East Berlin, Conn., has been awarded the contract for furnishing the iron work for the Messrs. Meara Brothers' new business block at Torrington, Conn. This building is to be three stories in height, and the girders, which are placed in the ceiling of the first floor, are of sufficient strength to support the two upper floors. The top floor is to be used as a dancing hall, and the structure has been designed with a view towards making the building as stable as possible, and avoid any vibration caused from the dancing in the hall on the upper floor.

AT the annual meeting of the Independence (Mo.) Gas and Coke Company the Directors chosen were: C. C. Chiles, D. Bullard, R. D. Wirt, W. H. Waggoner and Wm. McCoy.

THE San Francisco Gas Light Company has concluded not to purchase the building of the Young Men's Christian Association, which it proposed to devote to office purposes. The differences between the valuation placed on the property by the Association and the Company, and the fact that the changes required to place the building in suitable condition for the Company's needs would be too great, are responsible for the failure to bring off the trade. Meanwhile the Company is looking for a suitable dwelling place.

MR. E. P. CALLENDER, Secretary and Superintendent of the Little Falls (N.Y.) Gas Light Company, has been authorized by the proprietors to announce the following schedule of rates, to take effect from February 1st:

	Gross. per 1,000.	Net, per 1,000.
Supply for residences, etc.	$2 25	$2 10
Supply for stores, factories, churches, depots, etc.	2 00	1 90
For consumption of 10,000 to 25,000 cu. ft. per month	1 90	1 80
For consumption of 25,000 to 50,000 cu. ft. per month	1 80	1 70
Over 50,000 cubic feet per month		special rates.

For gas used for cooking and heating purposes, through separate meter, a special rate of $1.75 per 1,000 cubic feet gross will be made, or $1.65 net. To secure the net rate, bills must be paid at the Company's office on or before the 10th day of the month in which the same are mailed. The Company proposes to push the use of gas in accordance with current best practice, and if liberality and courtesy can accomplish the end in view, accomplished it will be.

AT the annual meeting of the Gas Light Company, of Augusta, Ga., the following Directors were elected: George T. Barnes, Leonard Phinizy, T. R. Wright, John R. Schneider and John M. Walton. The Directors subsequently elected the following officers: President, Geo. T. Barnes; Treasurer, H. B. Adam.

MR. JOHN MATHER has resigned from the position of General Manager of the Seattle (Wash.) Gas and Electric Light Company, the resignation to take effect on April 1st. He has no intention, however, of removing from Seattle. Mr. Mather has been in charge of the Seattle Company's affairs since August, 1892, and his connection with its interests has always been to its benefit.

MESSRS. H. J. Woolacott, George H. Bonebreak, John R. Haynes, A. Jacoby, W. J. Washburn and M. T. Allen are the reputed sponsors of the project to establish an opposition gas company for Los Angeles, Cal. They agree to supply gas at the rate of $1.35 per 1,000 cubic feet, and intimate that the Rew process will be the manufacturing system to be employed.

THE Berlin Iron Bridge Company, of East Berlin, Conn., has been awarded a contract for the placing of a steel floor in one of the buildings of the Messrs. Alexander Smith & Son's carpet factory, Yonkers, N. Y.

THE following resolutions were adopted at a meeting of the Directors of the Consolidated Gas Company, of Baltimore, Md., held in the Company's offices on the 8th inst.:

"At a stated meeting of the Board of Directors of the Consolidated Gas Company, of Baltimore city, held Feb. 8th, 1896, the following resolutions were unanimously adopted:

"*Resolved*, That it is with the deepest regret that the Board of Directors of this Company has learned of the death of Mr. Walter B. Brooks, who was connected with the management of the Company, as a Director, since its organization. Quickness of perception and resoluteness of purpose, together with sound judgment and regard for the rights and opinions of others, were prominent factors in the formation of a character that gained for him the respect of the community, and especially of those with whom he was associated in business affairs. Genial and warm hearted also in his personal and social relations, his associates were bound to him by strong ties of friendship and sincere esteem. We will regret his absence from the councils of our Company as one of its Directors, and sadly miss the presence of our friend.

"*Resolved*, That the foregoing resolution be entered upon the journal and a duly attested copy be sent to the family of Mr. Brooks.

"JOHN W. HALL, President. N. T. MEGINNIS, Secretary."

ON and after April 1st the net gas rate in Lynn, Mass., will be $1.10 per 1,000 cubic feet.

FROM the 21st annual report of the Board of Public Works, Detroit, Mich., detailing the operations of the Board for the fiscal year ended June 30, 1895, we learn that in August, 1894, a gas inspector was appointed by the Board in accordance with the instruction of the Common Council. Considerable delay was encountered in obtaining and setting up the necessary apparatus and machinery, and the office was not in complete operation until January 1, 1895. In April an arrangement was made with the Gas Company to inspect all meters before putting them in service, both new and those repaired, the Company agreeing to pay $100 a month for this service which has been done for the months of May and June. This, with receipts from other inspection, nearly puts the office on a paying basis. The present system seems to give general satisfaction to gas consumers. From January 1 to June 30, 1895, 601 meters were inspected. Of these 48 registered fast, with an average error of 4 per cent.; 14 registered slow, with an average error of 3.99 per cent.; 2 did not register at all; 1 would not pass gas, and 536 registered within the limits allowed by the ordinance—viz., 2 per cent. either way. Of the above, 76 were inspected and proved on complaint of consumers of gas, and 525 were new and repaired meters inspected on the account of the Gas Company. Of the 76 inspected on complaint, 25 registered fast—average error, 4.35 per cent.; 9 registered slow—average error, 3.87 per cent.; 2 would not register, and 40 registered within the 2 per cent. limit. The maximum pressure at which gas was delivered was 4.20 inches; minimum pressure, 1.20 inches; average mean pressure, 2.60 inches. The maximum illuminating value of the gas supplied was 22.60 candles; minimum, 19.61; average, 20.82.

IT is understood that Messrs. E. Squire, H. B. Tenzer, Wm. Martin, R. T. Whitaker and W. R. Faben have organized the Defiance (O.) Light and Fuel Company, to compete with the Defiance Light and Power Company.

ELSEWHERE we note the petition presented to the Massachusetts Legislature, which foreshadows the complete consolidation of the gas interests of the city of Boston. In supplement thereof we print the text of the following bill filed with the Legislature to legally provide for the consolidation:

Section 1. Permission and authority are hereby granted the Boston Gas Light Company, the Brookline Gas Light Company, the Roxbury Gas Light Company, the Dorchester Gas Light Company, the South Boston Gas Light Company, the Charlestown Gas Light Company, the East Boston Gas Light Company and the Bay State Gas Company, or any two or more of said Companies, to consolidate into one corporation, as hereinafter provided.

Sec. 2. Such of the Companies named in section 1 as desire to avail themselves of the Act shall, within six months from its passage, file with the Board of Gas and Electric Light Commissioners a certified copy, signed by the respective Presidents and Clerks of such Companies, of the vote of a majority of the shares of stock in such Companies, at a meeting of stockholders, accepting this Act and expressing an assent to consolidation upon the terms provided by this Act.

Sec. 3. The Directors of the Companies which have signified their acceptance of this Act as provided in section 2, shall, by a majority vote of all of the Directors of such accepting Companies, fix upon a proposed capital of a consolidated Company, and shall submit said proposed capital to the Board of Gas and Electric Light Commissioners.

Sec. 4. The Board of Gas and Electric Light Commissioners shall thereupon, as speedily as may be, hear such Directors and any others interested in the matter, if they desire to be heard, and shall determine whether said proposed capital is a fair valuation of the constituent Companies so assenting to consolidation. In case said Board determines that the proposed capital is not a fair voluation of the constituent Companies, then the Board shall fix and determine a fair valuation for each Company, and notify each Company of its action. The Directors of said Company may, within two months after such notification, accept said valuation as fixed by the Board as the capital of such new corporation, and file with said Board a record of such acceptance.

Sec. 5. Unless all of the Companies named in Sec. 1 shall within six months of the passage of this Act have proceeded as provided to consolidate, and unless the Companies shall have submitted to the Commissioners the proposed capital as provided in Sec. 3, within said time, and unless the Companies shall have assented to the value fixed by the Commissioners as provided by Sec. 4, within the time allowed by the Section, the Commissioners shall thereupon consider the expediency of the consolidation of all or any of the said Companies, and said Board shall thereupon determine a fair valuation of each of the constituent Companies, which said Board shall consider it expedient to be consolidated. The aggregate value thus fixed of all of said Companies shall be the proposed capital of a new and consolidated Company. In determining such expediency, said Board shall consider the action, if any, taken by any Companies under Secs. 2 and 4 of this Act. The Presidents of the several Companies assenting to such consolidation, shall thereupon incorporate such new and consolidated Company. The name of such new Company shall be determined by the votes of the said Presidents, and shall be one not in use by any other corporation in the commonwealth. The said Presidents shall incorporate said new Company as provided by the general laws under which manufacturing corporations are formed; the stock of said new Company shall be divided into shares of the par value of $100 each, and the capital of said new Company shall be equal to the total valuation of all the consolidated Companies as fixed by the Commissioners, which capital shall be distributed by the new Company among the several consolidated Companies on the basis of the values fixed by the Board of Gas Commissioners, upon surrender and cancellation of the certificates of stock in the constituent Companies.

Sec. 6. The said new and consolidated Company shall, after all the provisions of this Act are complied with, be entitled to have all the rights, privileges, franchises, choses in action and property of every name and nature belonging in any wise to each and all of the consolidated Companies at the time of such consolidation, and shall be liable for the debts of each of said Companies.

Sec. 7. The charters of all the Companies which the Commissioners have deemed it expedient to be consolidated as provided in Sec. 5, which refuse, or for three months after the receipt of notice neglect to join such consolidation, shall thereupon be revoked and annulled, provided the proposed capital fixed by the Commsisioners is not less than the total aggregate present capital of all of the constituent Companies.

LAST week we gave the main points in the ordinance adopted by the City Council, of Des Moines, Iowa, for the regulation of the supply of gas in that city by the Capital City Gas Company for the ensuing 15 years. On the 14th inst. Mr. E. G. Pratt and Mr. W. B. Keffer, acting for the Company, notified the authorities that the ordinance was accepted by it.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—B. Westermann & Co., of New York.

MONDAY, FEBRUARY 24, 1896.

The Market for Gas Securities.

The squabble over the "rights" of the introducers of bills in the Legislature, to cut the gas rate in Brooklyn and New York to $1 per 1,000 cubic feet, resulted last Friday in the reporting out from Committee to the notice of the Senate at large of Sullivan's bill, which in its original shape applied to both New York and Brooklyn. There was, however, a strong elastic band attached to the "reporting" of the bill, for it was hardly "out" of Committee before it was "in" again, but altered so as to have its provisions apply to New York only. To an outsider it looks that Mr. Coffey, of Kings, and Mr. Sullivan, of New York, have reached an amicable understanding as to the "rights" of each to deal with the Gas Companies of their respective cities—we take it for granted all our readers know that Mr. Coffey has a bill proposing to put the gas rate in Brooklyn at $1 per 1,000. Meantime under the influence of this juggling Consolidated sold off to 155, but recovered subsequently, and in the face of a generally ragged and dull market it opened to-day (Friday) at 157 bid, offered at 158. We have no hesitation whatever in saying that it is a purchase. The other city shares maintain fairly well the sharp advance of a week ago.

Brooklyn Union is booming again, the bid price having gone to 84½, while holders demand a point more. If these quotations are representative of the intrinsic value of the stock, Consolidated ought to be selling at 225. Chicago gas is steady, and Baltimore Consolidated is again approaching something like its normal value—59 is freely bid for it. Bay State is weak and lower, at 18 to 19½, which is strange, in view of the genuine attempt now underway to consolidate all the gas interests of Boston. Consumers, of Jersey City, is in better demand, and the bonds of the Company are quoted at 102 to 104. Hartford gas is slowly approaching the 150 mark, and it looks to us to be a purchase, particularly in view of the fact that in the near future the shareholders ought to have something in the nature of a stock dividend to recoup them for the large sums recently expended on extensions account.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

FEBRUARY 24.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	157	..
Central	500,000	50	150	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	213	216
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	245	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	38	40
Preferred	2,000,000	100	73¼	76
Bonds 1st 5's	3,500,000	1,000	100¼	101½
" 1st Con. 5's	1,500,000	..	87½	89¼
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	75½	77½
Preferred	5,000,000	100	109½	111
Bonds, 1st Mortgage, 5's	1,500,000	1,000	108½	110½
Yonkers	299,650	50	112	
Out-of-Town Companies.				
Brooklyn-Union	15,000,000	100	84½	85¼
" " Bonds (5's)	15,000,000	1,000	105¼	105¾
Bay State	5,000,000	50	18½	19½
" Income Bonds	2,000,000	1,000	..	80
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	77½	79½
2d " " "	3,000,000	1,000	51½	53½
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	68½	68½
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,000,000	..	66½	67
1st Mortgage	1,085,000	..	94	95
Consumers, Jersey City	2,000,000	100	77	..
" Bonds	600,000	1,000	102	104
Cincinnati G. & C. Co.	7,000,000	100	202	..
Consumers, Toronto	1,000,000	50	184½	187
Capital, Sacramento	500,000	50	..	41
Bonds (6's)	150,000	..	..	..
Consolidated, Baltimore	11,000,000	100	59	60
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,400,000	..	..	..
Detroit	4,000,000	..	..	29
" Con. Bonds	4,812,000	..	71½	75
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	73½	75½
" Bonds	2,000,000	..	84	87
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	136	142
" Bonds, 6's	2,650,000	..	101½	105
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	78½	82½
Bonds	1,000,000	1,000	85½	87½
Louisville	2,570,000	50	.	130
Laclede, St. Louis	7,500,000	100	24	24½
Preferred	2,500,000	100	83	84
Bonds	9,084,400	1,000	94	95
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	93	98
Bonds, 6's	4,000,000	.	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	46¼	..
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	71½	72
St. Paul Gas Light Co.	1,500,000	100	68½	70
1st Mortgage, 6's	650,000	..	88	90
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	64	66
Bonds, 5's	3,556,000	..	87½	90
Wilmington, Del.	500,000	50	188	190

Advertisers' Index.

GAS ENGINEERS.

	Page
Jos. R. Thomas, New York City	313
Wm. Henry White, New York City	315
Fred. Bredel, Milwaukee, Wis.	311
H. C. Slaney, Brooklyn, N. Y.	315
Geo. R. Rowland, New York City	315
The Western Gas Construction Co., Fort Wayne, Ind.	303
Humphreys & Glasgow, New York City	302
T. G. Lansden, St. Louis, Mo.	315
W. P. Elliott, New York City	297
American Gas Co., Phila., Pa.	298

CHEMISTS.

Herman Poole, New York City	297

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	313
United Gas Improvement Co., Phila., Pa.	305
Burdett Loomis, Hartford, Conn.	314
National Gas and Water Co., Chicago, Ills.	307
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	313
The Western Gas Construction Co., Fort Wayne, Ind.	306

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City	316
Continental Iron Works, Brooklyn, N. Y.	314
Deily & Fowler, Phila., Pa.	316
Kerr Murray Mfg. Co., Fort Wayne, Ind.	312
Stacey Mfg. Co., Cincinnati, Ohio	315
Bartlett, Hayward & Co., Baltimore, Md.	313
Davis and Farnum Mfg. Co., Waltham, Mass.	312
R. D. Wood & Co., Phila., Pa.	314
Isbell-Porter Company, New York City	314
Fred. Bredel, Milwaukee, Wis.	311
United Gas Improvement Co., Phila., Pa.	305
Berlin Iron Bridge Co., East Berlin, Conn.	302
National Gas and Water Co., Chicago, Ills.	307
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	313
The Western Gas Construction Co., Fort Wayne, Ind.	306
Humphreys & Glasgow, New York City	302
Gas Engineering Co., Pittsburgh, Pa.	312
American Gas Co., Phila., Pa.	298

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City	315
R. D. Wood & Co., Phila., Pa.	314
James R. Floyd & Sons, New York City	316
Continental Iron Works, Brooklyn, N. Y.	314
Gas Engineering Co., Pittsburgh, Pa.	312

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md.	313
Fred. Bredel, Milwaukee, Wis.	311
J. H. Gautier & Co., Jersey City, N. J.	311
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	310
Adam Weber, New York City	310

TAR AND CARBONIC ACID EXTRACTOR.

G. Shepard Page's Sons, New York City	315

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich.	296
G. Shepard Page's Sons, New York City	315
Gas Engineering Co., Pittsburgh, Pa.	312

GAS METERS.

John J. Griffin & Co., Phila., Pa.	320
American Meter Co., New York and Philadelphia	319
The Goodwin Meter Co., Phila., Pa.	318
Helme & McIlhenny, Phila., Pa.	319
D. McDonald & Co., Albany, N. Y.	319
Nathaniel Tufts, Boston, Mass.	318
Maryland Meter and Mfg. Co. Baltimore, Md.	318
Metric Metal Co., Erie, Pa.	317
Keystone Meter Co., Royersford, Pa.	318
The Hillen Meter Co., Brooklyn, N. Y.	319

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio	317
M. J. Drummond, New York City	317
R. D. Wood & Co., Phila., Pa.	314
Warren Foundry and Machine Co., New York City	317
Donaldson Iron Co., Emaus, Pa.	317
Addyston Pipe and Steel Co., Cincinnati, O.	316

GAS BAGS.

Peerless Rubber Mfg. Co., New York City	297

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City	311

GAS COALS.

Penn Gas Coal Co., Phila., Pa. ... 309
Perkins & Co., New York City ... 308
Despard Gas Coal Co., Baltimore, Md. ... 309
Westmoreland Coal Co., Phila., Pa. ... 309
Shaner Coal Co., Philadelphia, Pa. ... 297
Berwind-White Coal Mining Co., New York and Phila. ... 308
Henry C. Scheel, New York City ... 309

CANNEL COALS.

Perkins & Co., New York City ... 308
Henry C. Scheel, New York City ... 309

GAS ENRICHERS.

Standard Oil Co., New York City ... 309
The Sun Oil Co., Pittsburgh, Pa. ... 309
W. H. Townsend, New York City ... 309

COKE CRUSHER.

C. M. Keller, Columbus, Ind. ... 309

CONVEYING MACHINERY.

C. W. Hunt Company, N. Y. City ... 297

GAS GAUGES.

The Bristol Co., Waterbury, Conn. ... 296

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City. 307
Isbell-Porter Co., New York City ... 314
The Wilder Mfg. Co., Phila., Pa. ... 297

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City ... 314
Continental Iron Works, Brooklyn, N. Y. ... 314
G. Shepard Page's Sons, New York City. ... 315

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J. ... 310
B. Kreischer & Sons, New York City ... 310
Adam Weber, New York City ... 310
Laclede Firebrick Mfg. Co., St. Louis, Mo. ... 310
Cyrus Borgner, Phila., Pa ... 310
James Gardner, Jr., Pittsburgh, Pa. ... 310
Henry Maurer & Son, New York City ... 310
Baltimore Retort and Firebrick Co., Baltimore, Md. ... 310
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 310
Brooklyn Firebrick Works, Brooklyn, N. Y. ... 310

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N. Y. ... 310

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa. ... 299

MICA GOODS.

The Mica Mfg. Co., New York City ... 296

BURNERS.

C. A. Gefrorer, Phila., Pa. ... 314
George Bray & Co., Leeds, England ... 299
Theo. Clough, Dobbs Ferry, N. Y. ... 297

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 297

GAS TUBING.

New York Gas Tubing Co., New York City ... 297
J. C. Granger, New York City ... 297

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 307
Greenpoint Chemical Works, Brooklyn, N. Y. ... 307
Henry W. Douglas, Ann Arbor, Mich. ... 307

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind. ... 304
Isbell-Porter Company, New York City ... 314
Connelly Iron Sponge and Governor Co., New York City 307

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. ... 306
Chapman Valve Manufacturing Co., Boston, Mass. ... 306
R. D. Wood & Co., Phila., Pa. ... 314
Continental Iron Works, Brooklyn, N. Y. ... 314
The P. H. & F. M. Roots Co., Connersville, Ind. ... 304
Isbell-Porter Co., New York City ... 314
The Western Gas Construction Co., Fort Wayne, Ind. ... 306

ELECTRICAL APPARATUS.

Wm. Henry White, New York City ... 315

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa. ... 280
The American Gas Engine Co., Phila., Pa. ... 300
Backus Water Motor Co., Newark, N. J. ... 256

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City ... 316
W. G. & G. Greenfield, East Newark, N. J. ... 316

PURIFIER SCREENS.

John Cabot, New York City ... 311

GAS STOVES.

American Meter Co., New York and Philadelphia. ... 303
The Goodwin Meter Co., Phila., Pa. ... 318
George M. Clark & Co., Chicago, Ills. ... 301
Maryland Meter and Manufacturing Co., Baltimore, Md. 318
William M. Crane & Co., New York City ... 298
Keystone Meter Co., Royersford, Pa. ... 318
A. Welskittel & Son, Baltimore, Md. ... 584

CHINA GAS KILNS.

William M. Crane & Co., New York City ... 298

GASHOLDER PAINT.

New York Marine Paint Co., Poughkeepsie, N.Y. ... 306

RED CEDAR TANKS.

Williams Mfg. Co., Kalamazoo, Mich. ... 257

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y. ... 306

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md. ... 313
Continental Iron Works, Brooklyn, N. Y. ... 314
Deily & Fowler, Philadelphia, Pa. ... 316
Davis & Farnum Mfg. Co., Waltham, Mass. ... 312
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 312
Stacey Mfg. Co., Cincinnati, Ohio. ... 313
R. D. Wood & Co., Philadelphia, Pa. ... 314

PATENTS.

H. B. Willson & Co., Washington, D. C. ... 296

DIVIDEND NOTICE.

OFFICE OF WELSBACH COMMERCIAL COMPANY, 40 WALL ST., NEW YORK CITY, Feb. 13, 1896.

The Directors have this day declared a quarterly dividend of two (2) per cent on the preferred stock, payable on March 10, 1896, to stockholders of record at the close of business Feb. 29, 1896. Transfer books of the preferred stock will be closed from March 2 to March 10, both inclusive. Checks will be mailed.

1081-3 EDWARD C. LEE, Treasurer.

WANTED,

By a young man of 20 years' experience, a position to take full charge of a medium or small sized gas works; coal gas works preferred. A worker in all branches of the business—manufacturing, construction, mechanical and clerical; 7 years' experience in pushing the gas stove business. Would like a works where plant and business need building up. Can furnish competent and thoroughly reliable references.

1080-4 Address "P. V. T.," care this Journal.

Position Wanted

As Superintendent of Gas Works or Gas and Electric Light Works.

Has been in the employ of the Long Branch (N. J.) Lighting Company as Superintendent for the last 11 years, and is a practical mechanic, thoroughly understanding the laying out and erection of plant and the making of coal and water gas. Best of references. Address CHAS. J. LUTHER,

1079-4 Box 142, Long Branch, N. J.

WANTED,

Position as Superintendent or Manager of Coal Gas Plant,

By a thoroughly reliable, capable and energetic Gas Engineer. Best of references from present employers, whom he has served five years. Good reasons for desiring a change.

1079-3 Address "R. V.," care this Journal

POSITION WANTED

As Supt. or Manager of a Gas Works or Gas and Electric Light Works.

Fifteen years' experience as Manager of Gas Works and six years Gas and Electric Light Works. Good reasons for wishing to change present employment.

1043-tf Address "Y. B.," care this Journal.

FOR SALE,

All the Stock, Free of Debt, of a Small Gas Plant in Ohio.

Address "BARGAIN,"

1081-2 Care this Journal.

Wanted, Immediately,

Several Thoroughly Competent Meter Repairers.

Address, stating experience, references and wages expected,

T. LITTLEHALES, Gen'l Manager Gas Co.,

1080-3 Syracuse, N. Y.

Consulting Engineer.

An experienced and competent Engineer, thoroughly versed in all details relating to the manufacture and distribution of gas, will act as Consulting Engineer to a few more companies. Concise, accurate, and up to date methods employed, insuring economical operations and increased dividends. Terms moderate. Address "A. B. H.," care this Journal.

The Output of Bear Creek Cannel Coal—

the only high grade Gas Cannel available in large quantity—has been increased. We are anxious to add to our long list of Gas Companies using Bear Creek Cannel, and will be glad to furnish details as to cost and yield.

1080-4 MACFARLANE & CO., Louisville, Ky.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

PATENTS

Promptly secured. Trade-Marks, Copyrights and Labels registered. Twenty-five years experience. We report whether patent can be secured or not, free of charge. Our fee not due until patent is allowed. 32-page Book Free. H. B. WILLSON & CO. Attorneys at Law. Opp. U. S. Pat. Office. WASHINGTON, D. C.

MICA CHIMNEYS

MICA CANOPIES AND CHIMNEYS

For Welsbach Lights.

Send for Catalog and Discounts.

The Mica Mfg. Co.,

MICASMITHS,

No. 88 Fulton St., N. Y. City.

BRISTOL'S RECORDING **PRESSURE GAUGE**

For Continuous Records of

Street Gas Pressure.

Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

Send for Circulars.

THE BRISTOL CO.

Waterbury, Conn.

Received Medal at World's Columbian Exposition.

Patent Lava Gas Tips.

UNIFORMITY GUARANTEED.

ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

J. C. GRANGER,

successor to NICHOLLS & GRANGER

Manfr. of

GAS STOVE TUBING.

Guaranteed Best Quality.

PAT. END GAS TUBE.

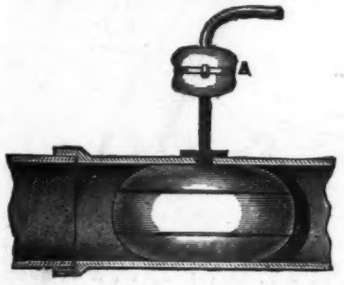
Patent Portable Tubing.

Speaking Tubing.

Elevator Tubing.

582 to 588 Hudson Street, New York City.

Peerless Patent Improved Gas Bag



These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficienty inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

3-in.	Gas Bag,	each,	$0.60	12-in.	Gas Bag,	each,	$5.00
4	"	"	.80	16	"	"	8.25
5	"	"	1.05	20	"	"	12.00
6	"	"	1.75	24	"	"	17.00
8	"	"	2.65	30	"	"	27.50
10	"	"	3.75				

The Peerless Rubber Mfg. Co.

16 Warren St., N. Y. City.

Gas and Water Works Extensions.

PIPE LAYING OVER OR UNDER WATER A SPECIALTY.

Competent Divers for Submarine Work sent to any part of the United States.

W. P. ELLIOTT, Gas Engr. & Contractor, Room 115, No. 115 Broadway, N. Y. City.

If You Want the Best GAS-TIGHT Tubing,

BUY OF THE

NEW YORK GAS TUBING CO.

771-779 Greenwich St., N. Y.

GUARANTEED NOT TO STIFFEN. Makers of All Kinds of Flexible Tubing.

HERMAN POOLE * Chemical Engineer,

323 West 34th Street, N. Y. City,

Makes a Specialty of

PURIFICATION

And the Utilization of Waste Products in Gas Manufacture

THEO. CLOUGH,

MANUFACTURER OF

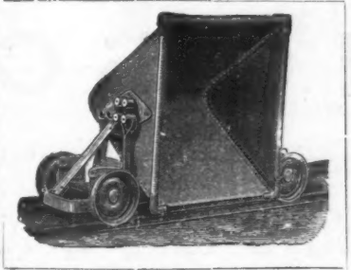
Clough's Patent Adjustable Gas Burners, Maxim Burners for Gasoline Gas Machines, Natural Gas Burners.

E. H. Nickel Tips for Water Gas.

Iron Burners of Every Description. Prices and Catalogue on Application,

THEO. CLOUGH - - - - - Dobbs Ferry, N. Y.

G. W. HUNT COMPANY.



THE HUNT TIP CAR.

COKE CARS for Gas Works,
TIP CARS for Carrying Ashes,
CHARGING CARS for Bringing Coal from the Storage Bins to Boiler Room and Retort Houses.

INDUSTRIAL RAILWAYS

Specially designed for handling material in and around

Gas Works, Coal Yards, Factories, Etc, Etc.

45 BROADWAY, - - NEW YORK.

THE GREATEST IMPROVEMENT IN GAS LIGHTING

Has been made by

WILDER'S VOLUMETRIC GOVERNORS.

They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.

WELSBACH LIGHTS are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.

THE WILDER MANFG. CO., - 816-822 Cherry St., PHILADELPHIA.

The Celebrated SHANER GAS COAL

CORRESPONDENCE SOLICITED.

Is Mined and Shipped from the Best Gas Coal Basin in Pennsylvania.

SHANER COAL CO., - 1326 Chestnut Street, Philadelphia.

SEND FOR NEW CATALOGUE, to be Issued Feb. 20th.

THE NEW VULCAN FAMILY RANGE.

WILLIAM M. CRANE & CO.,

Factory, 447-453 W. 14th St. **Office, 838 Broadway, N. Y. City.**

AMERICAN GAS COMPANY,

222 South Third Street, Philadelphia, Pa.

Owns, Operates, Buys and Leases Gas Works.

ALSO UNDERTAKES ALL KINDS OF CONSTRUCTION WORK.

Especially the Installation or Extension of Plants for the Manufacture of Gas from Caking Coal.

The attention of Gas Managers is particularly called to the many improvements in this method of manufacture instituted during the past fifteen years, and the extremely low cost at present of Coal Gas.

CORRESPONDENCE RESPECTFULLY SOLICITED. Address

GEO. G. RAMSDELL, Gen'l Mangr.

The Improved

Welsbach Light.

No. 34 Burner, with No. 74 Shade.

No. 34 Burner, with Nos. 10 and 43 Shades.

Welsbach Commercial Company,

Drexel Building,

PHILADELPHIA, PA.

Bray's Patent "Enamel" Gas Burners.

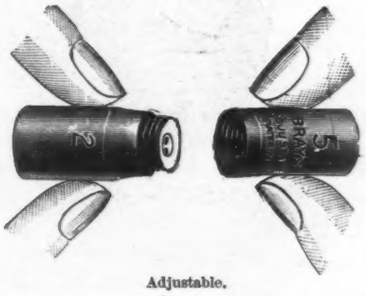
Bray's "Special" and "Adjustable" Burners

Are the Cheapest, Most Economical and Most Durable in existence, and will, at their REDUCED PRICE, save their cost in gas alone in forty hours' use.

Union Jet.

Slit Union.

Batswing.



Adjustable.

The "Specials" are made to Suit Low and High Pressures. The "Adjustables" consist of two Burners screwed together, the sizes of which can be arranged to suit any Pressure and Consumption. For full description see Catalogue.

See that **"Bray's Special"** or **"Bray's Adjustable"** is stamped on each kind of Burner.

ACETYLENE AND RICH OIL GASES.—We now make Burners suitable for use with these Gases.

TO BE HAD OF DEALERS THROUGHOUT THE STATES.

IN NEW YORK: E. P. Gleason Manufacturing Co., 181 to 189 Mercer St. Graham Anderson, 118 Walker Street.

IN BOSTON, MASS.: Waldo Brothers, 88 Water Street.

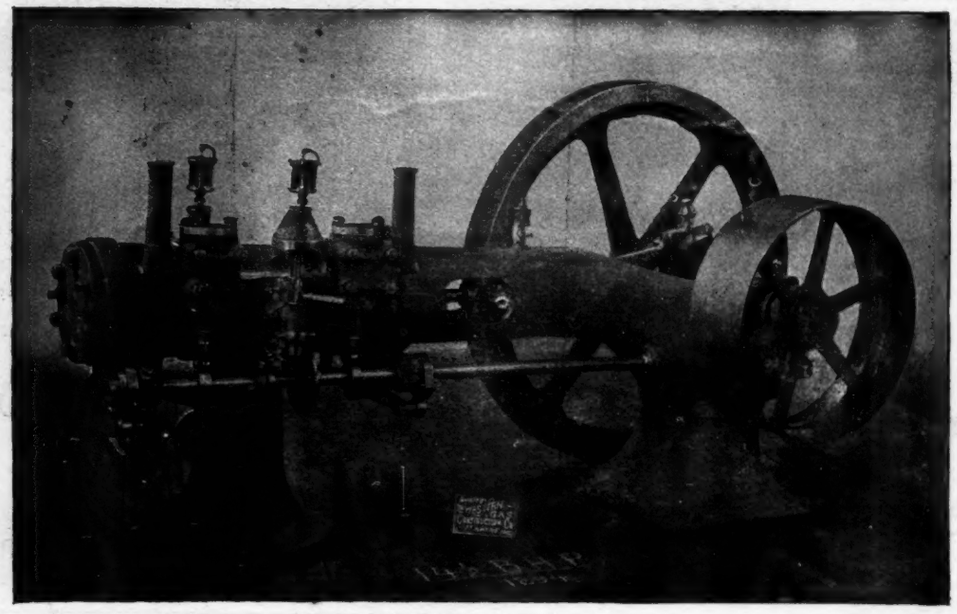
WM. W. GOODWIN, Prest. O. N. CULDLIN, V.-Prest. & Treas. H. B. GOODWIN, Sec. ERNEST F. LLOYD, Asst. Sec

THE AMERICAN GAS ENGINE CO.,

MANUFACTURERS OF

The Double-Acting Gas Engine,

Under the Patents of Griffin, and Dick, Kerr & Co., of London and Kilmarnock.



**

Single Cylinder.

Impulse Every Revolution.

(Two Strokes.)

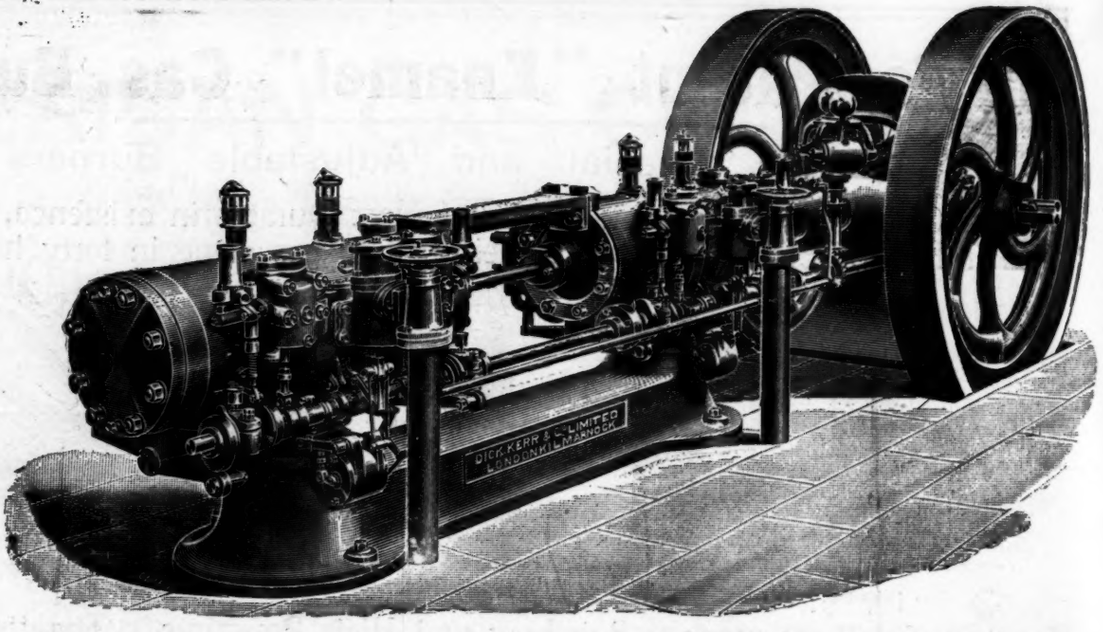
15 to 500 Horse Power.

For General Work and Isolated Electric Plants.

**

Tandem Cylinder. Impulse Every Stroke. 100 to 1,000 Horse Power.

For Central Stations and all work requiring extreme steadiness.



ESSENTIAL PRINCIPLE.—An impulse at each end of piston; using half force to each impulse; doubling the steadiness; reducing the wear on moving parts, and weight for given power. **CONSTRUCTION.**—The piston rod works through stuffing box in front end of cy inder, and connecting rod is carried in a cross-head working in a slide in frame, as in ordinary steam engine practice. All valves are of the poppet type, operated by cams on a single cam-shaft, giving positive movement to every working part. Tube or electric ignition. **RESULT.**—An engine of extreme simplicity and steadiness of action, the even wear on the cylinder and all working parts assuring increased economy, long life, and minimum cost in repairs. **RECORD.**—Successful and constant use in Great Britain for the past eight years. Address

W. W. GOODWIN, President, Lock Box 718, Philadelphia, Pa., or
THE WESTERN GAS CONSTRUCTION CO. Bldrs. & Gen. Agts. Fort Wayne Ind.

JEWEL GAS STOVES

A few of the world's best Gas Stoves. All prominent demonstrators of cooking use them. Nine-tenths of the Chicago apartment houses are furnished with the same . . . . . .

One Name
Covers All.

52 Styles of Cookers.

54 Styles of Heaters.

A JEWEL CATALOG IS WORTH THE ASKING.

GEORGE M. CLARK & COMPANY, Makers, CHICAGO.

Eastern Agency, 152-154 West 23d Street, N. Y. City.

SCIENTIFIC BOOKS.

GAS MANUFACTURE, by William Richards. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S GUIDE. $1.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards, C.E. 20 cents.

PRACTICAL TREATISE ON HEAT AND VENTILATION, with Special Relation to Illuminating, Heating and Cooking by Gas. By E. E. Perkins. $1.25.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

THE GAS WORKS OF LONDON. By Colburn. 60 cents.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THE MANAGEMENT OF SMALL GAS WORKS. By C. J. R. Humphreys. $1.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

DIGEST OF GAS LAW. $5.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR. By Geo. Lunge. New edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK. By William Mooney. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby, F.I.C. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatmen and Use in Construction. By A. H. Heath. $2.50.

ELECTRICITY.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Knapp $3.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., 32 Pine Street, New York.

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. GEO. H. SAGE, Secretary. FRANK L. WILCOX, Treasurer.

THE BERLIN IRON BRIDGE CO.

Engineers, Architects, and Builders of Iron and Steel Structures.

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Lynn Gas and Electric Company, at Lynn, Mass. The building is 37 feet in width by 64 feet in length, with brick side walls and an Iron Truss Roof covered with corrugated iron. A building of this kind cannot possibly take fire, as the interior appointments are such that there is little or no woodwork used about the construction of the plant, and no woodwork used about the side walls or roof.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

ALEX. C. HUMPHREYS, M.E., MANHATTAN LIFE BUILDING, (64 BROADWAY,) NEW YORK.

CABLE ADDRESS, LONDON & NEW YORK, "HUMGLAS."

ARTHUR G. GLASGOW, M.E., 9 VICTORIA ST., LONDON, S. W., ENGLAND.

HUMPHREYS & GLASGOW,

CONTRACTING AND CONSULTING

GAS ENGINEERS.

WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

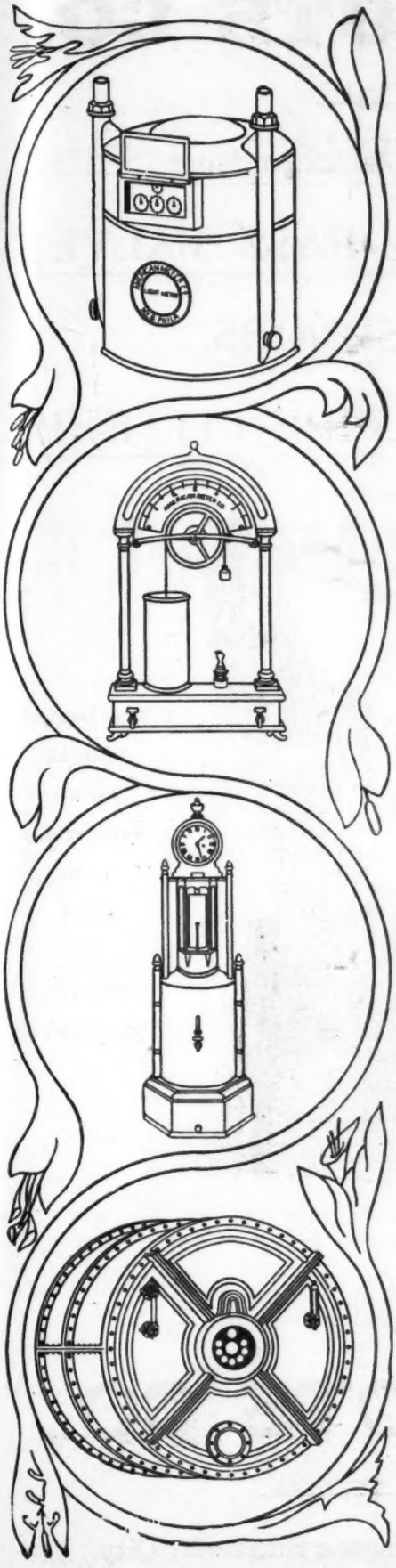
THE MANAGEMENT OF SMALL GAS WORKS.

By C. J. R. HUMPHREYS.

Price $1.

A. M. CALLENDER & CO., No. 32 Pine Street New York.

(Copyrighted, 1894, by the AMERICAN METER CO.)



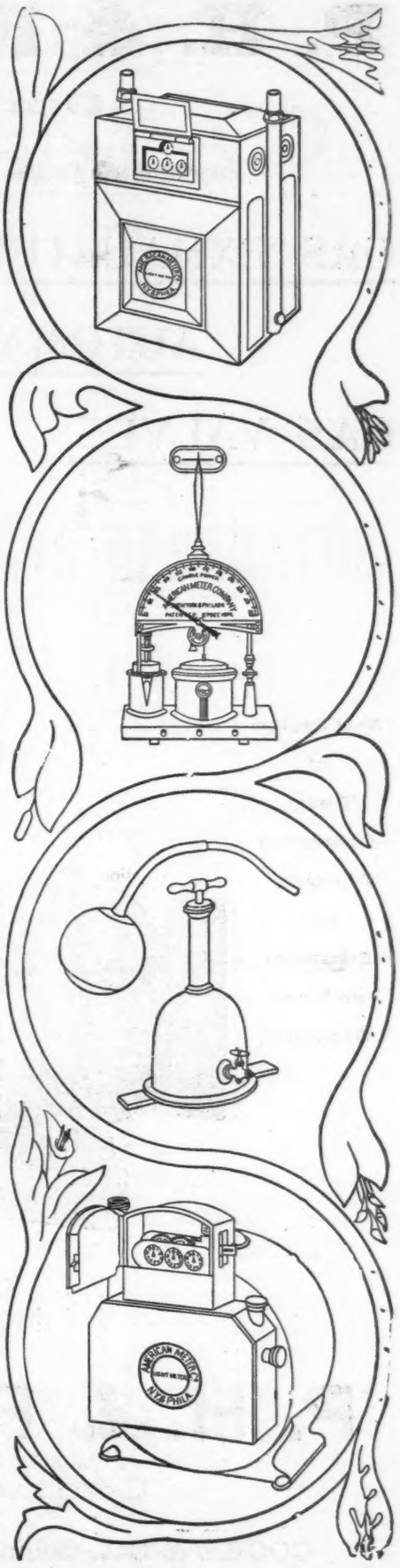
AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.



PUBLIC LIGHTING TABLE.

MARCH, 1896.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sun.	1	6.30 PM	9.30 PM	5.30	5.45
Mon.	2	6.30	10.50	5.30	5.45
Tue.	3	6.30	12.10 AM	5.30	5.45
Wed.	4	6.30	1.20	5.30	5.45
Thu.	5	6.30 LQ	2.30	5.40	5.35
Fri.	6	6.30	3.30	5.40	5.35
Sat.	7	6.30	4.20	5.40	5.35
Sun.	8	6.30	5.10	5.40	5.35
Mon.	9	6.30	5.10	5.40	5.35
Tue.	10	6.30	5.10	5.40	5.35
Wed.	11	6.30	5.10	5.40	5.35
Thu.	12	6.30	5.10	5.50	5.20
Fri.	13	6.30 NM	5.10	5.50	5.20
Sat.	14	6.30	5.10	5.50	5.20
Sun.	15	6.40	5.00	5.50	5.20
Mon.	16	6.40	5.00	5.50	5.20
Tue.	17	6.40	5.00	5.50	5.20
Wed.	18	9.40	5.00	5.50	5.20
Thu.	19	10.40	5.00	6.00	5.10
Fri.	20	11.40	5.00	6.00	5.10
Sat.	21	12.40 AM FQ	5.00	6.00	5.10
Sun.	22	1.30	4.50	6.00	5.10
Mon.	23	2.20	4.50	6.00	5.10
Tue.	24	2.50	4.50	6.00	5.10
Wed.	25	3.20	4.50	6.00	5.10
Thu.	26	3.50	4.50	6.10	4.55
Fri.	27	No L.	No L.	6.10	4.55
Sat.	28	No L. FM	No L.	6.10	4.55
Sun.	29	No L.	No L.	6.10	4.55
Mon.	30	6.50 PM	9.40 PM	6.10	4.55
Tue.	31	6.50	11.00	6.10	4.55

TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs. Min	By Table No. 2.	Hrs. Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142.10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00

P. H. & F. M. ROOTS CO.,

Connersville, Ind.

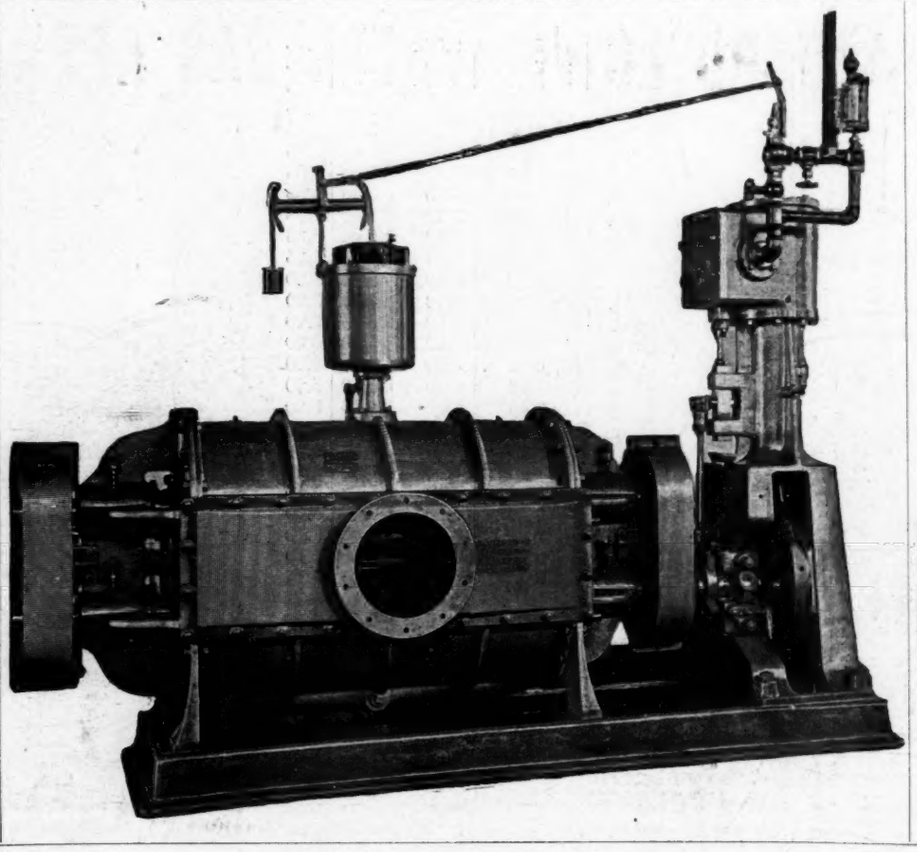
Exhausters with Combined Capacity of 75,000,000 Feet per Day Sold Last Season.

GAS EXHAUSTERS. BYE-PASS VALVES.

AUTOMATIC GAS GOVERNORS.

GAS VALVES. PIPE FITTINGS.

New Design of Direct Connected Engine and Exhauster on Same Bedplate.



This Design is Used for all Exhausters from No. 7 to No. 10, Inclusive.

Write for Illustrated Catalogue.
Estimates submitted on application.

P. H. & F. M. ROOTS CO.,

Connersville, Indiana.

COOKE & CO., Selling Agts., 163-165 Washington St., N. Y. City.

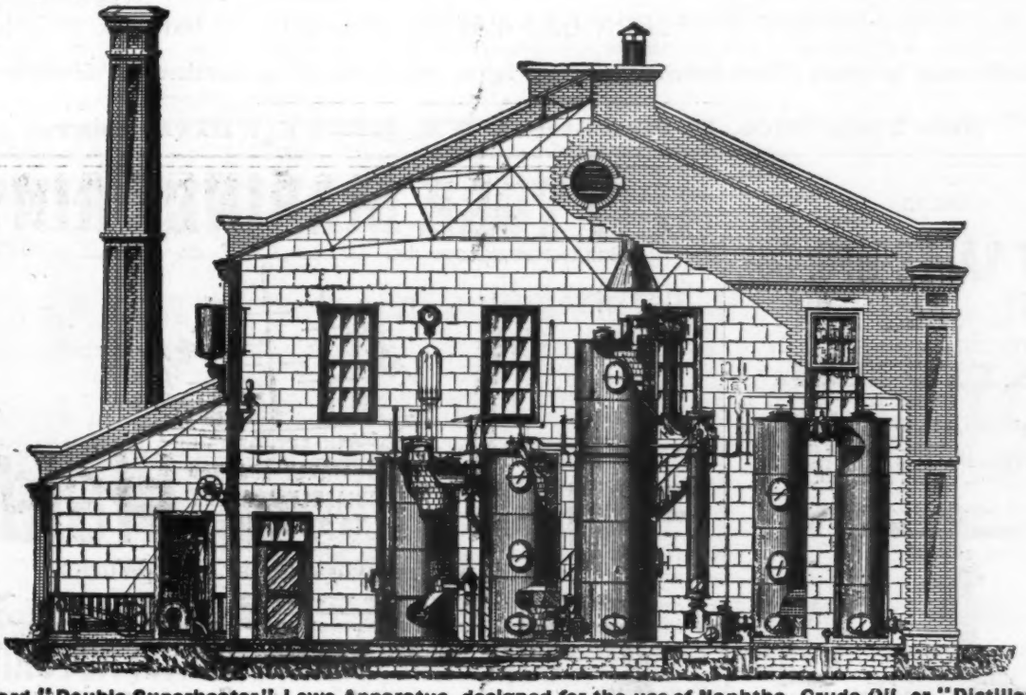
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

BUILDERS, LESSEES AND PURCHASERS OF GAS WORKS.

Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

THE WESTERN GAS CONSTRUCTION CO.,

ENGINEERS and BUILDERS,

FORT WAYNE, INDIANA.

Water Gas Apparatus . . .

Improved Double Superheater Settings,
Improved Single Superheater Settings,
Special Designs for Small Works.

Our apparatus is designed to use any grades of Oils or Naphthas, Gas House or Oven Coke, or Anthracite Coal. Results are Guaranteed.

Coal Gas Apparatus . . .

Agents and Builders { For FRED. BREDEL—Washers and Purifying System, Mouthpieces and Bench Castings.
For GEO. SHEPARD PAGE'S SONS—Walker Ammonia Concentrators and Sulphate Stills, Walker Patent Mouthpieces.

Manufacturers of THE WESTERN GAS VALVE, all Iron, Double Gate, 4 to 36 Inch.

Purifiers, Condensers, Scrubbers, Street Main Specials, Iron Roofs, Iron Floors, Oxide Elevators and Conveyer Machinery.

New York Office, 32 Pine Street, WM. HENRY WHITE, Engr.

THE

LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ¼ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

SEND FOR CIRCULAR.

ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

OFFICE AND WORKS:
938 to 954 River St. & 67 to 83 Vail Av.
TROY N Y.

NEW YORK MARINE PAINT CO.

Successors to TRACY & HADDEN.

TRADE MARK
MANUFACTURERS OF

PAINT PECULIARLY ADAPTED TO STAND ON Holders

And all Ironwork about Gas Works.

POUGHKEEPSIE, N. Y.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independen Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston Mass
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

70 Bush St., Near Division Ave., Brooklyn, N. Y.

The Gas Engineer's Laboratory Handbook.

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 32 Pine Street N. Y. City

NATIONAL GAS AND WATER CO.,

218 La Salle Street, Chicago.

Builder and Operator of Gas Works.

The Rew Soft Coal Carbureted Water Gas Apparatus.

TESTED BY TWO YEARS' PRACTICAL OPERATION, AND FULLY GUARANTEED.

Plans and Estimates Upon Application.

IRWIN REW, President & Treasurer. N. A. McCLARY, Secretary & Gen'l Manager. E. E. MORRELL, Engineer.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION. REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 365 Canal St., New York.

Practical Photometry.

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

By William Joseph Dibdin.

Price, $3.00.

A. M. CALLENDER & CO.,
32 Pine Street, N. Y. City.

DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) **Ann Arbor, Mich.**

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

JOHN SCHRIEVER, Manager.

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y

BOOKS.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR.
By George Lunge. Price $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.
By David A. Graham. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.
A. M. CALLENDER & CO.,
32 Pine St., N. Y. City

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

350 Pages, Full Gilt Morocco. Price, $8.00.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING

Standard Gas Coals and Cannel.

Ocean Mine Youghiogheny Gas Coal,

From Baltimore.

Clinch Valley, Thacker & Logan Gas Coals

From Norfolk, Va.

Old Kentucky Shale and O. K. Boghead,

From Kentucky,

The Most Valuable Enricher Now Obtainable.

Second Only to the Celebrated Australian Shale.

Cargo Shipments from New York, Philadelphia, Baltimore and Norfolk.

Single carloads or more delivered at any required point in the United States or Canada.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:

55 Broadway, New York.

Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng., having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

GAS ENRICHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point, Baltimore, Md.
OFFICE, - - - 44 South Street, Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

HENRY G. SCHEEL,

Tidewater Sales Agent and Shipper of High Grade Westmoreland Vein, Youghiogheny, and West Virginia

Thoroughly Screened

GAS COALS.

Superior Kentucky Gas Cannel, Connellsville and Mountain Coke, Clearfield and Cumberland Vein Steam and Smithing Coals.

Room 176, Washington Building, No. 1 Broadway, N. Y. City.

WILBUR H. TOWNSEND,

BROKER AND DEALER IN

Naphthas, Gas and Fuel Oils and Crude Petroleum for Gas Companies.

Room 164, 29 Broadway, N.Y. City.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

GREENOUGH'S "DIGEST OF GAS CASES."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. MCCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St, Phila., Pa.

THE SUN OIL CO.,

OHIO CRUDE OIL,

38 to 41 Degrees Gravity.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J.H. GAUTIER & COMPANY

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,

Gas House and other Tile.

Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

ADAM WEBER, Proprietor.

Manhattan Fire Brick and Enameled Clay Retort Works

Works, Weber, N. J.
Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

AND

Standard Fire Brick and Gas Retorts.

Works,
OCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Conestoga Bldg., Wood & Water Sts.
PITTSBURGH, PA. P. O. Box 373.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1850.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.

A cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD & CO.,

N. 3d & Prospect Avs., Mt. Vernon, N.Y.

Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,

Mermod-Jaccard Building, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,

AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents for New England States.

PRACTICAL PHOTOMETRY.

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00. A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

FRED. BREDEL, C. E.,

PROP'R OF KLOENNE AND BREDEL PATENTS.

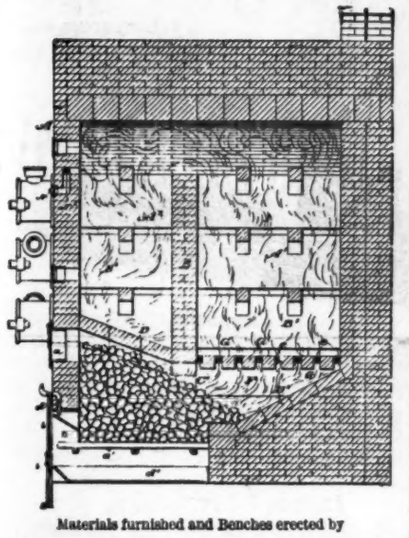
Recuperative Furnaces, Purifying Machines,

* Gas Apparatus. *

No. 118 Farwell Avenue, Milwaukee, Wis.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J

Address as above, or D. D. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL.

$3.00 per Annum.

A. M. CALLENDER & CO.

32 Pine Street, N. Y

A CONVENIENT

BINDER for the JOURNAL

STRONG.

DURABLE.

LIGHT.

SIMPLE

CHEAP.

HANDSOME.

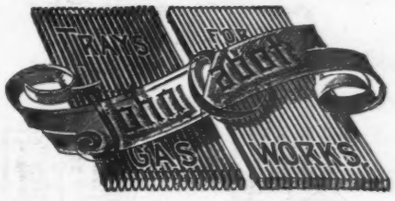
Price, $1.

A.M. Callende & Co., 32 Pine st., N. Y. City

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired



306-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.

Send for Circulars.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON. Supt., 621 Broadway, N. Y

FIELD'S ANALYSIS

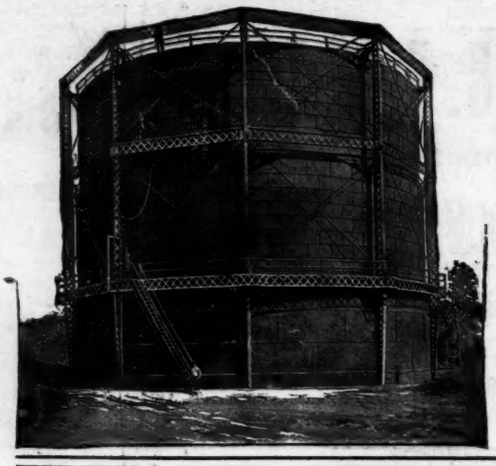
For the Year 1894.

An Analysis of the Accounts of the Principal Gas Undertakings in England, Scotland, and Ireland. Being the Twenty-fourth Year of Publication. Compiled and Arranged by

JOHN W. FIELD Accountant to the Gas Lt. and Coke Co., London.

Price, $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

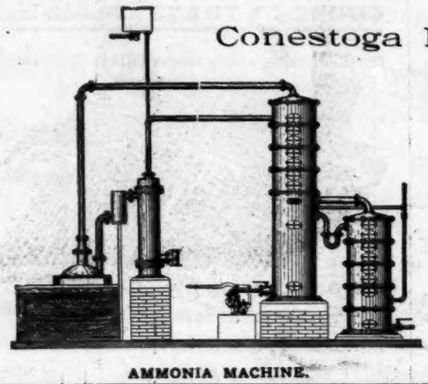
Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

GAS ENGINEERING COMPANY,

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

Gas Works Machinery of all kinds,

PATENTEE AND OWNER OF

PITTSBURGH WASHER-SCRUBBER,

SOLE AGENT FOR

FELDMANN AMMONIA MACHINE,

For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

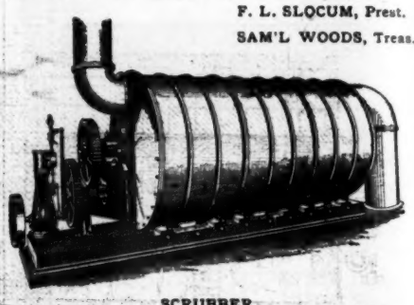
The Erection of Bi-Product Coke Ovens a Specialty.

Faux System of Recuperative Benches,

JAS. GARDNER, JR.
SOLE CONSTRUCTOR AND BUILDER.

NEW SYSTEM HYDRAULIC MAIN.

F. L. SLOCUM, Prest.
SAM'L WOODS, Treas.



SCRUBBER.

INCREASE YOUR PURIFYING CAPACITY

BY THE USE OF THE

"Crighton" Four-Box Center Seal Cap.

Having recently perfected and patented a Five-way Center Seal Cap, we are now in position to offer and recommend it to Gas Companies for increasing their purifying capacity at a moderate cost.

With this Cap you can have **all your Purifying Boxes in constant use,** and where four boxes are in operation at one time, **the capacity is increased one-third.**

Your present Center Seal can be used, and will **only require a new Cap.** Under ordinary circumstances **the change can be made in one day,** and will not necessitate the disturbing of your connections.

Now is the time to make the change, as the work can be done to good advantage during the season of your lightest output.

For information and prices address

KERR MURRAY MFG. CO.,

Manufacturers of Gas Works Apparatus and Holders,

FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double & Single-Lift

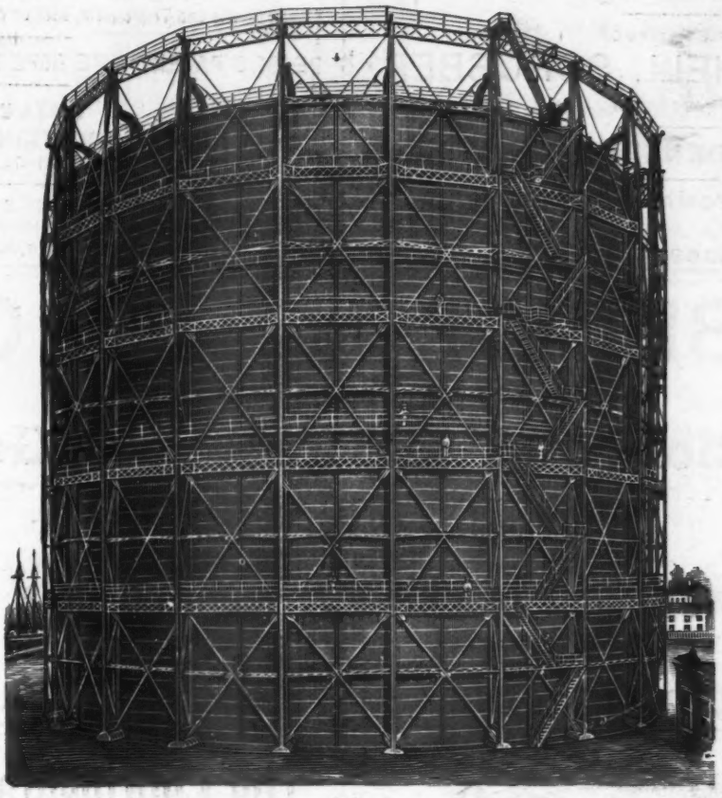
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS



PURIFIERS.

CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS.

Boilers.

Three Four-Lift Gasholders, each of 4,289,500 Cubic Feet Capacity, Erected in Chicago.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

W. H. PEARSON, President. J. T. WESTCOTT, Gen'l Mang'r & Treas. L. L. MERRIFIELD, Chief Engineer.

The Economical Gas Apparatus Construction Co., Ld.

269 Front Street, East, - - Toronto, Canada.

ENGINEERS AND BUILDERS

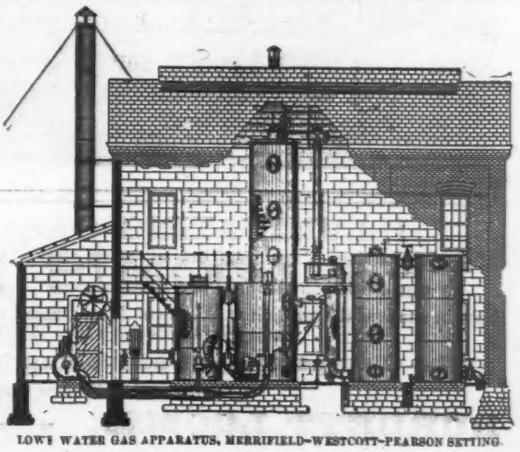
OF THE

Improved Lowe Water Gas Apparatus

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.



LOWE WATER GAS APPARATUS, MERRIFIELD-WESTCOTT-PEARSON SETTING.

Foundries and Works: {Millville, N. J. Florence, " Camden, "

R. D. WOOD & CO.

ENGINEERS, IRON FOUNDERS, MACHINISTS

400 Chestnut Street, PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE

SOLE MAKERS OF

THE MITCHELL SCRUBBER

(PATENTED)

PURIFIERS, CONDENSERS, SCRUBBERS.

THE HOPPER AUTOMATIC GAS GOVERNOR.
BENCH WORK. PLATE GIRDERS.
IRON FLOORS AND ROOFS.

BUILDERS OF

GAS HOLDERS

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks

PEASE'S PATENT WIRE ROPE GUIDING FOR GAS HOLDERS

CUTLER'S
PATENT FREEZING PREVENTER
FOR GAS HOLDER CUPS.

THE TAYLOR REVOLVING BOTTOM GAS PRODUCER,
HEAVY LOAM CASTINGS, DUNHAM SPECIALS, HYDRAULIC WORK
LAMP POSTS, VALVES, ETC.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

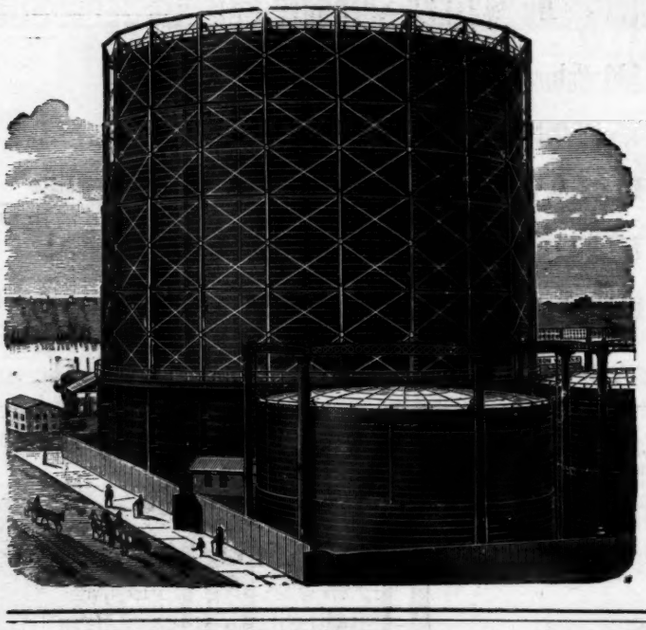
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. -OFFICES- Bridge & Ogden Sts., Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, JR., Secretary & Treasurer.

BROOKLYN, N. Y.

TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM N. Y. TO GREENPOINT.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers
Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

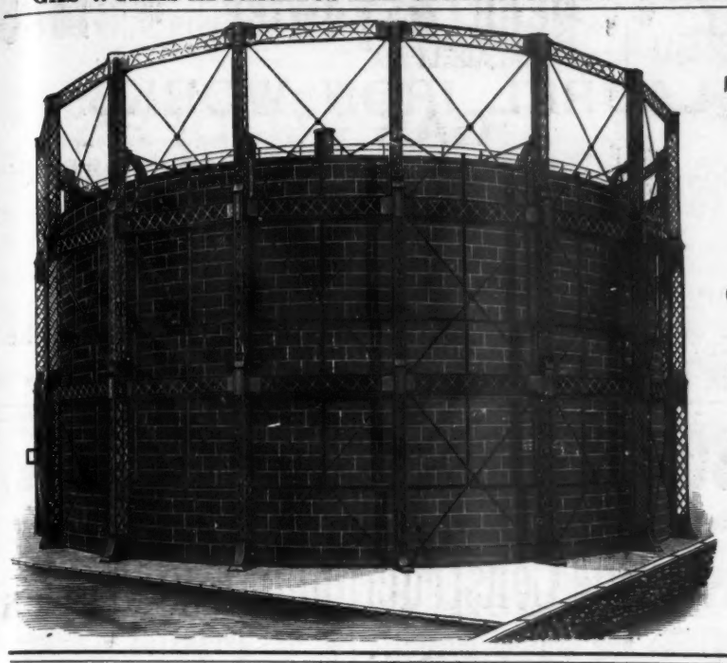
BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

We make to order CAP BURNERS to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFROREH,
948 N. 8th St., Phila., Pa.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO.

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

George Shepard Page's Sons,

Sole Agents for

The "Standard" Washer-Scrubber,

The Walker Tar and Carbonic Acid Extractor, The Walker Sulphate and Ammonia Still,
The Walker Self-Sealing Pressed Steel Mouthpiece Lids.

The Berlin Center Valve. And Contractors for Ammoniacal Liquor.

No. 69 Wall Street, New York City.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

H. C. SLANEY,
Gas Engineer
466 Sixth Street, Brooklyn, N. Y.
Plans, Specifications and Estimates furnished for New Works, Alteration or Extension of Old Plants.

T. G. LANSDEN,
Consulting and Contracting Gas Engineer
Estimates, Plans and Specifications for New Works (Coa or Water Gas), and for Extensions or Alterations.
Room H, 108 N. 4th St., St. Louis, Mo.

WM. HENRY WHITE,

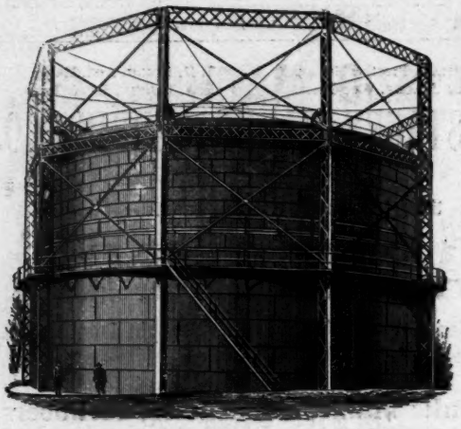
No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.



1842 * Deily & Fowler, * 1896

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD & SONS, Successors to HERRING & FLOYD, Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

Premium Awarded, World's Columbian Exposition.

HEARNE CENTER SEAL, Operating One, Two, Three or Four Boxes.

THE HAZELTON OR PORCUPINE WATER TUBE BOILER.

The Best Boiler in the World, and the Cheapest per Square Foot of Heating Surface.

Unequaled for the Economical Production of Very Dry Steam.

WE GIVE Liberal Capacity, Highest Efficiency, Absolute Safety and Thorough Workmanship.

WE SOLICIT the Critical Examination of the Mechanical Profession and the Steam-Using Public, and Your Trade.

Send for Catalogue and Reports of Tests.

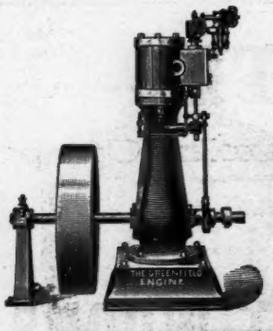
The HAZELTON BOILER COMPANY,

Sole Proprietors and Manufacturers,

Cable Address, "Palla," New York. Tele., "1229-18th St.," New York. Gen'l Office, 716 E. 13th St., N.Y., U.S.A.

Cast Iron Pipe For Natural or Artificial Gas, Flange Pipe, Electric Light Posts.

The Addyston Pipe & Steel Co., Cincinnati, O.



GREENFIELD Steam Engine Works.

Established 1874.

MANUFACTURERS OF

Greenfield Stationary, Portable and Yacht ENGINES AND BOILERS.

Also Horizontal, Automatic and Variable Cut-off Engines

Sizes from 3 to 75 Horse Power.

Also Vertical and Horizontal and Marine Boilers. Steam Pumps and Adams' Crate Bars.

W. G. & G. GREENFIELD, - - EAST NEWARK, N. J.

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants

The Gas Engineer's Laboratory Handbook.

BY JOHN HORNBY, F.I.C. Price, $2.50,

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York City.

GAS AND WATER PIPES.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS

Columbus, Ohio.

Management of Small Gas Works.

By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY

The Chemistry of Illuminating Gas.

By NORTON H. HUMPHREYS. Price, $2.40.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

GAS METERS.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

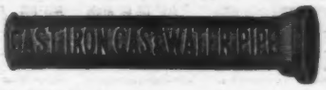
New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc

M. J. DRUMMOND,



SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

GEORGE ORMROD, Manag. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

1894 DIRECTORY 1894

OF AMERICAN GAS COMPANIES

Price, - - - - - - - - - $5.00.

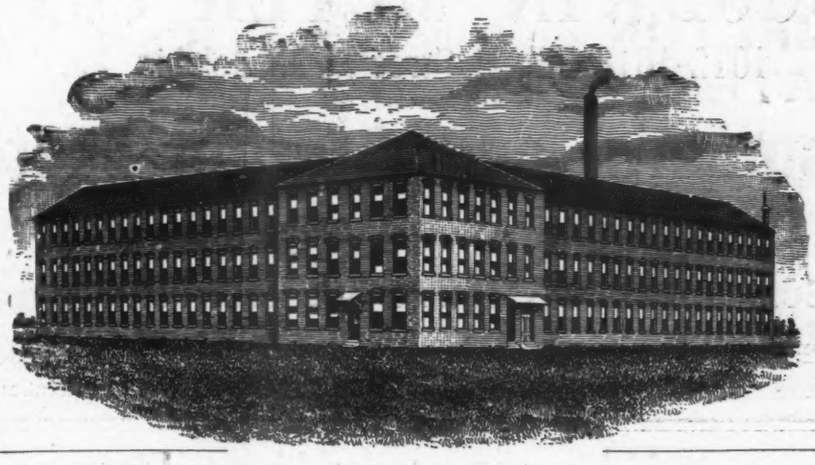
A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

N. Y. AGENCY,

Bartlett Lamp Mfg. Co.,

137 & 139 W. Broadway, New York City.

Telephone, 1125 Courtlandt.



Factory and Office

ERIE, PA.

ESTIMATES FURNISHED ON APPLICATION.

METRIC METAL CO.,

MANUFACTURERS OF

Dry Gas Meters

FOR ALL KINDS OF SERVICE

Special Attention Paid to REPAIRING METERS OF ALL MAKES.

Agts., McELWAINE-RICHARDS CO., 62 & 64 W. Maryland St., Indianapolis, Ind

Established 1849. With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

153 Franklin St., Boston, Mass.

C. W. HINMAN, - - Manager.

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges,

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

THE GOODWIN METER COMPANY,

1012-1018 Filbert Street, Philadelphia, Pa.

MANUFACTURERS OF

Consumers' and Station Meters,

Standard Photometrical and Analytical Gas Apparatus

"SUN DIAL" GAS COOKING AND HEATING STOVES.

Particular attention given to Repairing Meters and Scientific Apparatus. . . .

GEORGE B. EDWARDS, Agent,
113 Chambers Street, N. Y. City.

THE KEYSTONE METER CO.,

Factory and Office, ROYERSFORD, PA.

WESTERN MANAGERS:
CAHILL, SWIFT & CO.,
121-207 South Seventh Street,
ST. LOUIS, MO.

PACIFIC:
WIESTER & CO.,
15 & 17 New Montgomery St.,
SAN FRANCISCO, CAL.

Gas Meters and Gas Stoves.

GAS METERS. GAS METERS. GAS METERS.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
125 & 127 S. Clinton Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

Gas Meter Manufacturers

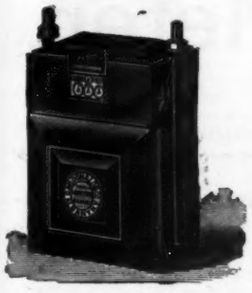
1339 to 1349 Cherry Street, Philadelphia, Pa.

Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Center Seals, Pressure Registers, Governors, Indicators, Photometers

AND ALL OTHER KINDS OF APPARATUS FOR USE IN GAS WORKS.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of ALL MAKERS.



D. McDONALD & CO.,

Established 1854.

154 West 27th Street, NEW YORK CITY.
51, 53 & 55 Lancaster St., ALBANY, N. Y.
34 & 36 W. Monroe St., CHICAGO, ILL.

MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

(Established 1881.)

THE HILLEN METER CO.,

Manufacturers of Gas Meters.

All Sizes of Meters Constantly in Stock. Liberal Discount on Application.

Special Attention Paid to Repairing Meters of All Makers.

Address all Communications to

JOHN J. HILLEN, - - 200 Baltic Street, Brooklyn, N. Y.

NOT CONNECTED WITH ANY OTHER ESTABLISHMENT.

The Advertisement of the

OTTO GAS ENGINE WORKS,

33d and Walnut Streets, Philadelphia,

New York, 18 Vesey St. Boston, 19 Pearl St., Chicago, 245 Lake St.,

Occupies this space every alternate week.

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia.

52 Dey Street, New York. WM. S. GRIBBEL, Manager.

75 N. Clinton St., Chicago. FREDERICK WAUGH, Manager.

MANUFACTURERS OF

STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 30,000 now in use.

We manufacture in the United States, under the **SAWER & PURVES PATENTS**, the

Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

Needs only the care given an ordinary Meter. Saves MONEY, TIME and CONSUMERS, Dispenses with "DEPOSITS" and increases OUTPUT.